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Storage and Disbursement of Small Tools

The Different Ways of Keeping Track of Tools—Single and Double Check Systems—The Register System—Check Room of the Future

By W. J. SANSOM

A MODERN tool storage and disbursement system, in order to be efficient, should be based upon the principle of "a place for everything and everything in its place." When any particular system is selected as being best fitted to the conditions obtaining, there must be consistent and persistent fufillment of all details connected therewith, for it is well known that an intermittent system is worse than no system at all. Care should be taken to install the system that will best suit the condition and that provides for the upkeep of the tools. A plant manufacturing a standard product, year in and year out, can install a different method of disbursement of tools from that desirable where the product is subject to change. Therefore the writer will explain how various systems are applied and to which class of shop each one is suited.

In addition to the problem of disbursement, attention will be given to the storage, ordering, maintenance, inspection and final disposition of tools, together with suggestions for blank forms to be used in connection with the different systems outlined. It is earnestly recommended that a capable man with good mechanical training be placed in charge of the tool service department. He should be a man in whom confidence can be placed to direct intelligently all phases of the work such as the ordering of small tools, repair parts for machinery and the maintenance of small tools for the entire plant, one who is broad-minded enough to settle disputes that are bound to arise with the workmen and adjust these differences to the satisfaction of and with justice to both employer and the employee. Such a man, who in addition to the foregoing qualifications can take care of the details, it is the details that count in this branch of factory management, is a valuable asset to any organization.

Tool Checking Systems

The single check system is the one in common use and, contrary to general belief, is not very efficient as there are greater opportunities for losses than appear upon first consideration. The employee, when he applies for tools, is given a check number which is recorded and serves as an identification. A stated number, usually ten, of stamped metal checks bearing this identification number are then issued and the workman, upon making a request for a tool, will leave one of these checks to be placed in the bin from which the tool is taken. When the tool is returned it is again placed in the bin and the check returned to the workman.

The double check system involves a set of checks with the workman's identification number stamped thereon to be furnished for each employee, an identification tag or card, and metal checks of a different shape than the number checks, stamped with the names and sizes of the tools in stock. The workman is given an identification number stamped on a large metal tag, or perhaps a printed card which is arranged to display the identification number in prominent figures and should also be arranged so that his own signature will appear thereon. This identification tag or card must be shown when tools are called for.

Card Record Check

Inside the tool room, a large board should be located at the most convenient point for the attendant's use and having a double row of hooks, the upper row to receive the ten checks bearing the workman's number, the lower row for the checks that are stamped with the names of the tools that the employee is using. Each tool bin must also have two hooks, one for the number check and the other for the check which is stamped with the name of the tool. In making requisition for a tool, let us take for instance a one-inch machine reamer, the workman will give his identification number which we will assume is number 50. The check room attendant will take one check numbered 50 from the board and hang it on the hook in the bin containing the one-inch machine reamer, remove the check marked one-inch machine reamer from the bin and hang it on the hook below the number check on the board and deliver the tool to the workman. Upon the tool being returned the procedure is reversed.

Under the plan known as the card record and check system, all tools that are likely to be a part of the workman's permanent outfit, such as oilcans, wrenches, files, brushes, etc., are recorded on a card which is filed at the time the tools are issued. Other tools that are to be used only for short periods are checked to him by one of the checking systems. Should the employee be discharged or resign he is expected to return the tools checked and also the tools charged to him on the record. In the event of tools on record being worn out, new ones are given out when the old ones are returned to the checkroom or credit given on the record if the tools are not replaced.

No metal checks are used in the disbursement of tools under the register plan with the exception of an identification tag. A register is used like the McCaskey or American, together with written memorandum slips made in duplicate. To all intents and purposes it is practically the same method as used in many grocery stores for charge purchases. Each check room attendant is furnished with a duplicate pad and as the individual employee receives tools he is given the original

slip with his number and a description of the tool he has received written thereon. The duplicate is filed under the employee's number in the register. When the tool is returned the original slip accompanies it and the original and duplicate are then destroyed, thus closing the transaction. This method has many advantages which are explained later.

Denominational checks may be used to good advantage on certain classes of tools and are useful especially when workmen are engaged on tool or repair work where large numbers of a few kinds of tools are to be used. These checks may be issued, of a different shape from the ordinary check, with the workman's number on the face, the reverse side being stamped 2, 3, 4 or 5 and may be used on such tools as bolts, straps and jackscrews. None of the checking systems are really suitable for pattern or wood shops, as a tool is generally used for only a short period and perhaps by the entire working force at least once during the day. All tools, however, including band saws, routers, saw files, templets and all other tools owned by the employer should be charged directly to the foreman of the department. To maintain an accurate record, breakages or renewals must be promptly recorded thereon. General tool accounts of this nature, to be kept accurate, should be checked four times a year and oftener if found necessary.

System for the Erecting Floor

If the erecting floor is a large department and situated at a distance from the machine shop checkroom, a separate room may be maintained to contain all tools that are used in the department and, while the tool disbursement expense may be increased, there will be greater efficiency in output. The time spent in walking back and forth to the distant check room is avoided as also is the probability that tools intended for erecting floor use may be in service in the machine shop. It requires very little nonproducing time of workman to pay for the services of the extra check room attendant and the congestion will naturally be less at the machine shop check room. This will materially assist the production of that department.

When a tool is broken in use, the employee should not be able to go to the check room and replace it without the knowledge of his foreman for the reason that by so doing the foreman would not have the opportunity to discover the cause of breakage and to take the necessary steps to avoid a repetition of the damage. "Tool breakage" reports should be carried by each foreman, should be filled out when the tool is to be replaced and the check room attendant instructed not to replace any broken or worn-out tool except upon receipt of the breakage report signed by the foreman. A simple form is shown in Fig. 1.

TOOL BREAKAGE Date _____

Workman _____ Check No. _____

Name of Tool

Broken } Line thru one
Worn out }

Reason for breaking:-

_____ _____

Tool Director Foreman

FIG. 1—TOOL BREAKAGE REPORT FORM

A daily or weekly report may then be made out for the superintendent by the tool director giving the tool breakage in condensed form. See Fig. 2. This report would be compiled from the tool breakage reports issued by the shop foreman and would enable the superintendent to keep in close touch with the amount of and reason for the breaking of tools.

STATEMENT OF TOOL BREAKAGE

Total _____ For week ending _____ 191

Departments:	Mon	Tue	Wed	Th	Fri	Sat
Machine						
Assembling						
Foundry						
Tool						
Forge						
totals:						

Tool Director.

FIG. 2—WEEKLY REPORT ON TOOL BREAKAGE

When a workman resigns his position or is discharged, his tool account should be carefully scrutinized and steps taken to have all tools returned to the check room. A report should be made to the accounting or time keeping department certifying that the employee's account is clear or, should there be tools lost, notation should be made on the report to that effect. The form in Fig. 3 may be used.

Single Check System

The single check system, while the simplest and least costly in its operation, has many weak features that too often are allowed to pass unnoticed. A few simple instances are given: The check room attendant may place the workman's check on the wrong hook, he may accidentally knock the checks off the hooks and in replacing them be in doubt as to where they belong and he may perhaps replace them on the wrong hooks, the employee may return a certain tool in exchange for another and the attendant neglect to change the check from the first to the second tool. All these errors will occur every day in a check room of any size and especially in shops where the prevailing practice is to employ for tool checking young boys, whose sense of responsibility is usually lacking or only partly developed.

Often a tool checked to a workman is lost in the shop or perhaps it has been loaned by him to another employee and the transaction forgotten. Again it is not an uncommon practice for a workman to use a tool that is charged against another man without asking his permission and when the loss is discovered the workman against whom the tool is charged will quite frequently disclaim all knowledge of the tool to the attendant. After considerable argument, to avoid congestion at the tool room window while the discussion is going on and consequent delay in giving out tools to other workmen, the attendant will be forced to give the workman the benefit of the doubt because he fears that the check might have been misplaced in the check room through one of the errors above explained. In the same way the employee might break a tool and attempt to evade the

responsibility for the act by denying that he had received it.

Those readers who have not actually had charge of this branch of shop management, may doubt that these are common occurrences and will not believe that workmen will distort the facts to such an extent. The vast majority of people are honest and the workman who

CLEARANCE CARD

Name _____ No. _____

has returned all tools to the check department except

Date _____ Tool Director

FIG. 3—WORKMAN'S CLEARANCE CARD

will prevaricate about tools in all probability would not remove one cent's worth of material from the plant for his own use. The course of reasoning usually followed by him is that the tool is in the shop somewhere, he hasn't it anyway, and why should he have it charged up to him or receive a reprimand from his foreman if he can talk his way out of the difficulty. Considerable time may therefore be lost in finding checks when tools are returned to the checkroom and, in most cases, useful machine time is lost in addition to the labor.

When inventory is taken all tools must be accounted for and in a large plant this will necessitate that some tools be returned to the check room quite a considerable time before the employees leave work so that all will be able to turn in their tools by quitting time. As a consequence some workmen will be idle between the time that their equipment is called for and the regular quitting time of the shop. There will be similar loss of time on the day following inventory as it would be impossible to start every workman promptly, each man having to await his turn at the check room window for the necessary tools.

Inventory Difficulties

What has been said regarding the single check system is equally true of the double check system and, in addition, the extra work involved in handling two sets of checks must also be borne in mind. Furthermore, if twenty men were using the same size and kind of tool simultaneously then there would have to be twenty tools each with its check ready for use. An advantage over the single check system lies in the fact that each tool could be stamped or otherwise marked with a number and each name of tool check given a corresponding number so that identification of the tools that any workman might have would be complete. This system, however, would necessarily entail considerable work in its installation if a large number of workmen are to be furnished with tools and would be rather cumbersome in its execution.

The card record and check system combined is a step in advance of the plain check system but is open to the same objections as above except for the few tools that may be kept on the card record. The register system is an improvement over the previous methods as there are no metal checks whatever to be considered and while there is a slightly increased cost of operation in providing pads instead of metal checks the ultimate saving through the absolute knowledge of who is charged with each tool will more than balance the small cost of the pads. This system has none of the drawbacks that the check systems have for the simple reason that all transactions are duplicated in writing, one copy retained by the check room and the other by the workman receiving the tool. If he does not receive the tools listed to him, the workman would report it for correction at the time of receiving the tools and the charge slip.

Responsibility Settled

There cannot be any future argument regarding his responsibility for the tools. The employee is given a clip holder like that in Fig. 4 for filing all the charge slips that may be in his possession and it may either be hung on a nail by his machine or bench or kept in the tool box. He has the advantage of knowing exactly how his account stands at the check room simply by referring to his file, as all tools when returned to the check room are accompanied with the charge slip issued therewith. Upon the tools being returned to the check room, no time is lost in looking up checks as a glance at the charge slip and the tools will usually suffice to prove that the correct tools are returned and the workman is immediately released to return to his work of production. The tools are returned to their proper place at the check room attendant's convenience. Separate boxes may be placed at a convenient point to receive charge slips returned and charge slips issued and these also may be filed, or the duplicates, in the case of charge slips returned, removed from the register at the attendant's leisure. Objection may be made that it will require too much time for the attendant to write out the slips, but, as a matter of fact, it is a quicker operation for the competent attendant to write the charge slips than to take checks from the workman and hang them on a hook in the bin and then reverse these proceedings when the tools are returned. In addition, the shortening of the non-productive time of the employee through avoiding the necessity of waiting for checks is considerable in the aggregate.

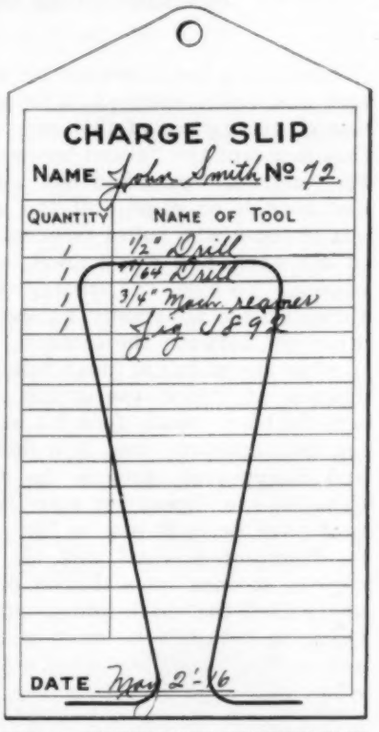


FIG. 4—WORKMAN'S CHARGE SLIP

It is customary in some plants to keep the check allotted to the workman on a board within the check room, the attendant taking the checks from the board when the tools are returned. In that event, the workman need not be detained after his tools are returned

to the check room while the attendant is looking up his checks although it might be preferable from the check room attendant's viewpoint were he to do so. It would be possible for the wrong tool to be turned in and the error undiscovered until after the workman had left the check room, thus making it necessary for the attendant to take the matter up for adjustment later.

If the double checking system is used then there would be the name-of-tool checks on the board, as previously explained, to correspond with the tools that the workman has received and the check room attendant in that case would only find it necessary to take these from the board and compare with the tools returned, placing the tools in their respective bins at his convenience.

In preparing for inventory under the register system, it is not necessary that tools be returned to the check system as the register system automatically provides a perpetual inventory of tools in use in the shop so that a clerk may take a copy of the tools listed in the register and count only the tools that are in storage. A saving may thus be made in workman's time at the inventory period and is an important consideration in favor of the register system. This method also provides adequately for the loan of equipment to other employees who may not have identification numbers such as office people or others outside of the works who may borrow tools. In addition, tools used by a department as a whole and not chargeable to individuals, as for instance, band saws in the pattern shop, may be recorded in the same manner.

The check room has not received the attention it has deserved until recent years but since scientific methods have been applied to shop management the importance of this department has been more fully recognized and its operation more systematically developed. The writer, in looking ahead, makes the suggestion that in the future the ideal check room will consist merely of a private storeroom from which tools will be delivered to groups of machines by an overhead carrier system and returned to the check room in the same way. The workman will be charged with the tools by a register system similar in every detail to the cash register used in all stores. There will be no occasion for the workman to leave his machine, neither will it be necessary for the tool attendant to leave the check room. A check room so managed that no workman wastes valuable time waiting for tools is indeed rather hard to imagine, but so were some of the recent developments in management only a few years ago, and while the writer is aware that the ideal check room is hard to develop, it must be admitted that the requisite conditions are not impossible.

Machine Shop Bulls—III

By Joe V. Romig

Tim Doolin had bulled his job again, a shaft this time, and was busily engaged in trying hard to dope out a way of getting out of this mean scrape. He knew well that it meant the "grand bounce" for him if Jennison, his foreman, would find out, and so he schemed how best to hide or dispose of the bulled shaft. Tim was one of those who bulled frequently, through inattention to his work, and was known by all to be on his last chance. To hide, and where, were his thoughts as he threw off the apparently finished shaft and placed another one between the centers.

After the midnight lunch hour, things usually quieted down a bit, and it was during these hours that Jennison, the boss, usually took his wee bit of a nap. Choosing this opportune time, Tim shouldered the bulled shaft and disappeared through the side door of the shop. Crossing over twenty or more tracks of the mill's railroad yard brought him to the river bank, down which he disappeared, shaft and all. Reaching the river's edge he scooped out a shallow ditch with an old tin can and socked the shaft into its grave with a vengeance. Covering it lightly he went back to his work, thinking and smiling about how good a job he had made out of a bad one.

While still smiling to himself, at 3 G.M. a heavy hand was held on his shoulder and there stood Murphy, the head detective.

"Say bo, who is your foreman?" he inquired of the frightened Tim. "Go get him quick," he continued, "he is wanted out here in the yard, right away."

Not wishing to cause suspicion or get in wrong with the copper, Tim went and hunted up Jennison and brought him to the still waiting Murphy, chief of the detective staff.

Jennison was told that he and his man here, were wanted to attend an inquest over on the river bank, and slipping quietly over to the now frightened Tim, Murphy inquired whether he would go over with or without the cuffs. Tim leaped into the lead of the party, taking them straight over the tracks to his dead and buried bull.

He was told to dig, and out came the shaft, which he was ordered to carry back again into the shop. Murphy then turned to Jennison, and said, "I have now done my duty, you do yours," and walked away, knowing that justice would be meted out accordingly.

After a few moments of reflection, Jennison turned to poor Tim and said, "Tim, firing is too good for a guy like you; I'll keep you on, but from now on and forever, you will be called the 'undertaker' of machine shop No. 8." And the name stuck, for even to this day he is known and called by his nickname, Undertaker.

"Three-Handed Workers"

By A. W. Brown

Some one, let us say Sydney Smith, who gets credit long after his death for most good things that we can not exactly place, has said that some persons have three hands: "two like you and me, and *a little behind hand!*"

Every badly managed plant has some of these. They cause loss not only by doing less work than they are paid for, but by keeping others waiting for supplies, instruction or service; also by their bad example.

A good remedy is to deduct from the pay envelope or the check a sum representing the late minutes or hours, and paying it into an employees' sick fund or amusement "kitty."

It is disagreeable for most employers to drive the lesson of punctuality home through the purse of a worker.

Being prompt is almost entirely a matter of habit and the rut of lateness is very likely to spread beyond a man's time at the shop. Amputated at work, "the little behind hand" will be lost in his daily life.

FIG. 1—A GENERAL SHOP VIEW

A Machine Shop Which Moved Out of the City

Increasing Business Made Expansion Necessary—A New Shop Nine Miles Out of Baltimore—Layout of Shop and Arrangement of Departments

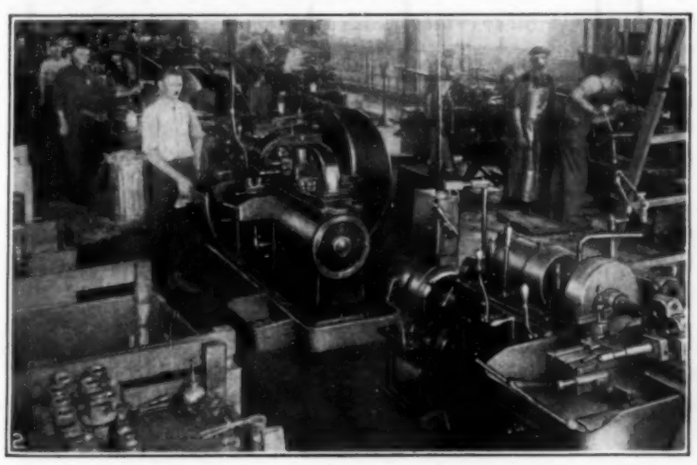
SPECIAL CORRESPONDENCE

THERE has been talk of decentralization in machine building, both on account of the difficulty of securing additional room in cities and the advantages of light, air and freedom from transportation difficulties in some cases. Therefore, when the need for expansion became urgent for them, the Black & Decker Manufacturing Co. found a site at Towson Heights, about 9 miles out of Baltimore, Md. The company there erected a new plant and the story of growth, which made this expansion necessary, is interesting.

Beginning back in September, 1910, Messrs. Black & Decker began business as tool and jig designers, builders of special machinery and also of a few electric tools. According to Mr. Black, in order to raise capital for a start, he sold his automobile for $600 and Mr. Decker raised a like amount from some similar source. Things grew very satisfactorily until 1914 when it was decided that as special machinery depended too much on the personality of the principals, they would specialize on some staple product. They settled on electric drills and air compressors.

The shop shown herewith was built in the fall of 1919 and ready for use early in 1920. Some of its features, both of construction and equipment, are worth consideration by others who are contemplating getting out of the city and away from the crowds. The building is a high, single story one with a monitor in the center. It is 13 ft. in the clear with 5 ft. 5 in. more to the roof. The monitor is something over 5 ft. more. A general idea of the construction, as well as the large window area, can be had from Figs. 1 and 2.

In Fig. 1 is shown a general shop view with the assembly in the foreground. This shows the location of the steam radiators up in the girders and the distribution of light all over the shop. The illustration, Fig. 2, shows mostly Potter & Johnston machines, with their



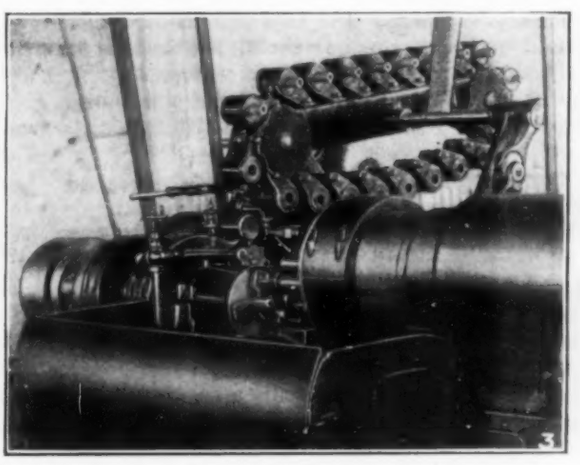


FIG. 2—POTTER & JOHNSTON DEPARTMENT. FIG. 3—MAGAZINE FEED FOR BUSHINGS

curved oil guards, the types of bins and benches used and the kind of step ladder used for overhead work. An interesting detail of manufacture is shown in Fig. 3, where a Cleveland automatic with magazine attachment is used to handle cast bushings. Casting the bushings eliminated the use of solid rod as stock, with the resultant saving in metal.

Part of another assembly department is shown in Fig. 4, while the testing bench for drills and grinders is shown in Fig. 5. Each unit being tested is plugged into a light circuit the same as in practice. The instruments show current consumption at all times. Being away from city restaurants, an eating place became a necessity, hence the cafeteria shown in Fig. 6.

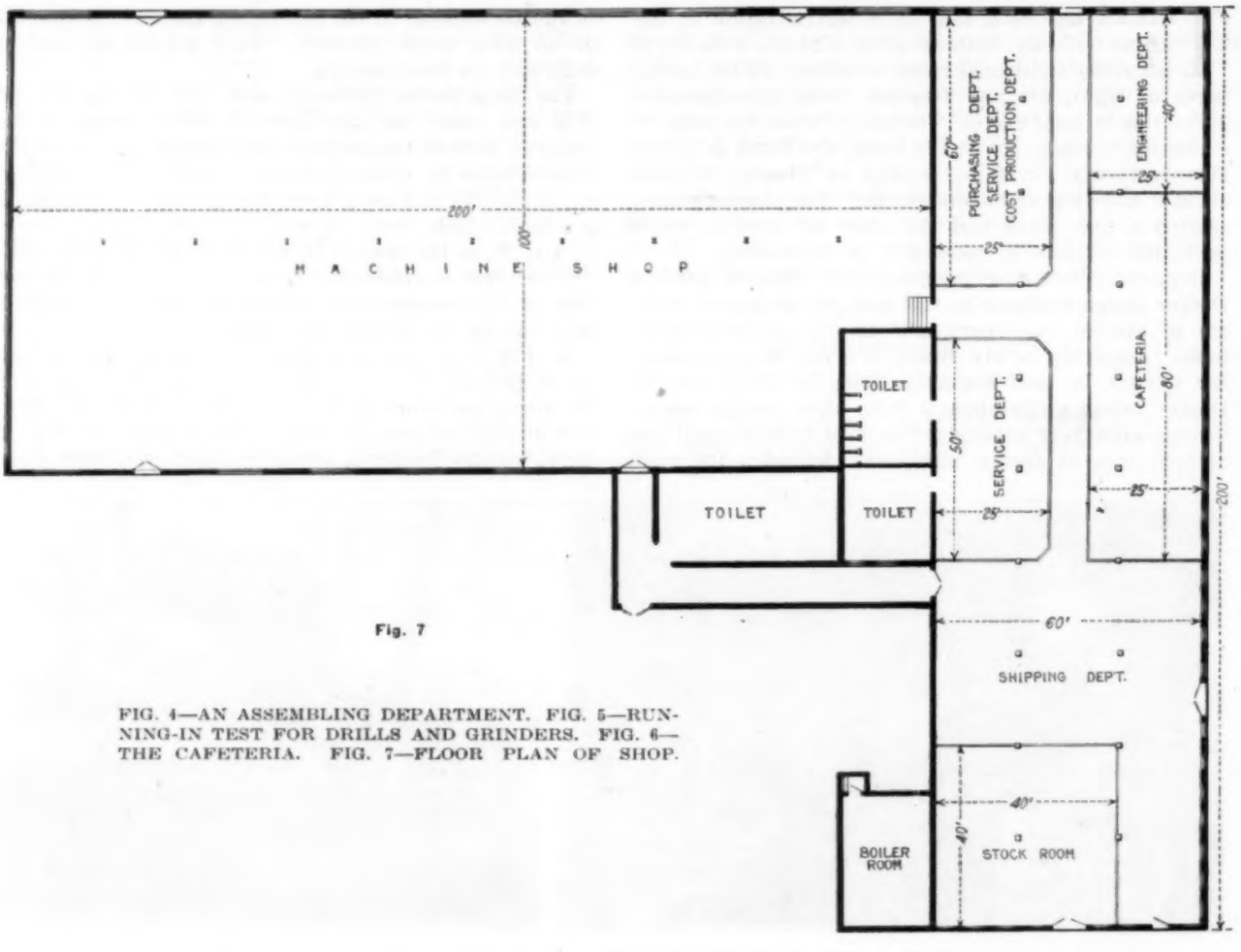


Fig. 7

FIG. 4—AN ASSEMBLING DEPARTMENT. FIG. 5—RUNNING-IN TEST FOR DRILLS AND GRINDERS. FIG. 6—THE CAFETERIA. FIG. 7—FLOOR PLAN OF SHOP.

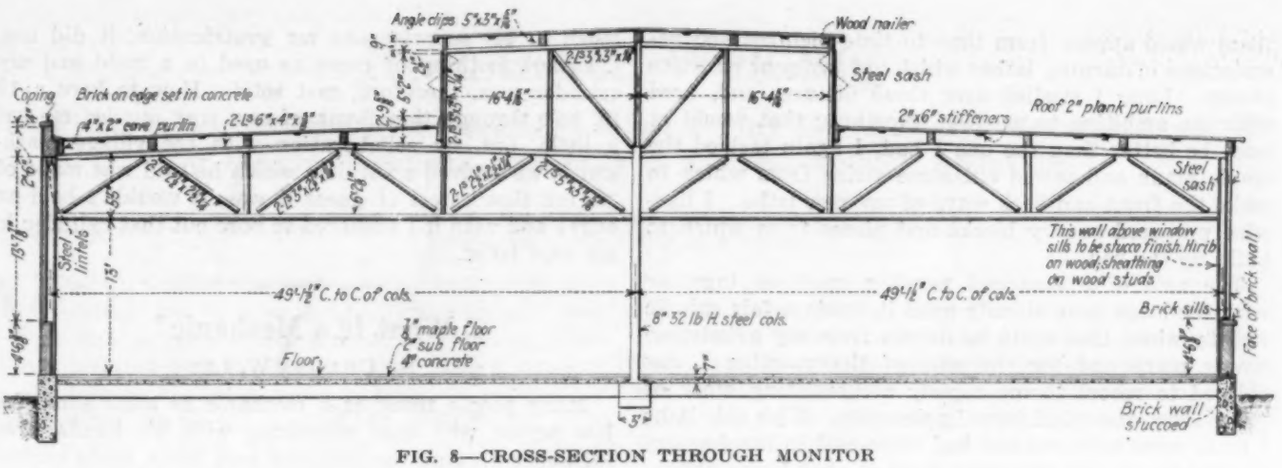


FIG. 8—CROSS-SECTION THROUGH MONITOR

The plan of the shop is shown in Fig. 7, while Fig. 8 is a cross-section giving the principal dimensions to anyone who has need of a similar shop. The exact floor layout can, of course, be altered to suit conditions but the general construction will be found serviceable in many places. This move into the country also involved the building of a number of houses along very attractive lines. Anyone interested can secure information as to these houses as well as further details of the shop buildings and their equipment.

Learning the Trade Forty Years Ago

BY W. S. DAVENPORT

(The first of four articles)

Boys of the present day who are mechanically inclined and who live within easy reach of the modern vocational and trade schools, with their able instructors and complement of fine machinery upon which to work, little realize the difficulties that beset the boys of 40 years ago who wished to "learn the machinist's trade." When I was a boy and lived on a farm among the hills of old New England I wanted to run machinery. Though at that time the term "machinist" was unknown to me, I knew the kind of work I wanted to do and the rare opportunities that came to me, perhaps once or twice in a long year, to visit the machine shop in a neighboring town were wonderful treats indeed. Well do I remember saying, one Sunday morning on my way to church, that I wanted to "work in iron," a desire that greatly perturbed my good mother, who had pictured me a farmer like my father and most of her acquaintances.

In the summer I was kept pretty busy during my hours away from school, attending to the many minor duties about the farm. Thus, I had little chance to indulge my craving for machinery, but with the coming of autumn and the harvest time there came also the traveling threshing machine with its crew and I was in my glory. This machine was driven by an old-fashioned horsepower in which a pair of horses were made to walk continually up an interminable hill while the "ground" beneath their feet was as constantly sliding backward.

SAWING WOOD AND THRESHING GRAIN BY HORSEPOWER

Later in the season, when it was time to prepare the winter's stock of firewood, the threshing machine was replaced by the "dragsaw," a wonderful device operated by a system of gears and cranks and driven by the same horsepower. Never, thought I, could anything be more marvelous than the way the wheels turned and the reciprocating saw was pushed rapidly back and forth, never could logs be severed more quickly.

A crank churn, with gears and wheels to make the floats revolve, was of absorbing interest and to me a mowing machine was about the finest piece of mechanism that could possibly be evolved.

My father, like all New England farmers, was "handy with tools" and possessed an assortment of saws, chisels, planes and other implements of the carpenter's trade in which I early became interested. At the age of ten years, I could split a log and prepare the pieces with plane and saw and chisel to make picture frames and other simple objects. For this work I received considerable commendation and was told that I would make a good carpenter, if I would stick to it.

MY FIRST LATHE

My grandfather, who lived in a neighboring town, had a wood turning lathe that he had built and rigged up to be driven by a belt from the grindstone, the hired man at the crank of the grindstone supplying the energy. I could not command the services of a hired man but, inspired by the example of my grandfather, I set out to construct a lathe of my own.

The shaft of an old churn furnished the spindle for this lathe, while odds and ends from broken down or worn out farm machines, pieced out with blocks and strips of hard wood, provided the remainder. For a power plant a discarded grindstone was seized upon and to this I fitted a square shaft made by rip-sawing (by hand) a hard maple plank, 2 in. thick, and by whittling the ends of the resulting square strip round with a jackknife.

For "bearings" I bored holes with an augur in the legs of the carpenter's bench and to one end of the shaft I fitted an unique pedal motion, a duplicate of which has never been seen before or since its construction. Notwithstanding the crudeness of the device, it could be made to run and, with a good deal of exertion and perspiration, I was actually able to accomplish some creditable wood turning upon it.

Like many another farmer's boy I had the *Youth's Companion* and in the premium lists of that publication

there would appear from time to time pictures and descriptions of turning lathes which put my poor effort to shame. Long I studied over these pictures and, fired with the ambition to produce something that would at least be better than the one I had, I again tackled the maple plank and sawed out some strips from which to make the front and back ways of my new lathe. I likewise prepared sundry blocks and pieces from which to build up the bed.

The axle of a scrapped mowing machine, together with the large gear already upon it, made a fair spindle and fly-wheel that could be driven from my grindstone power plant and for the rest of the machine I was obliged to resort to my rapidly accumulating stock of parts from discarded farm implements. With this lathe I made some patterns and had them cast in the foundry of the shop in the adjoining town so that I was able to build a jig saw that was the envy of all the boys around.

My First Acquaintance With Twist Drills

I could devote only odd moments of leisure to my shop. I was a long time in reaching this stage and, in the meantime, I had graduated from the *Youth's Companion* to the *Scientific American*. In this periodical, I had seen the advertisements of the Morse Twist Drill & Machine Co., and had painstakingly studied over them until I had acquired a considerable technical knowledge of drill gage sizes, machine screws and threads.

Though pennies were to me more scarce than are dollars to many of the boys of now-a-days I carefully saved up enough money to send for a $\frac{1}{8}$ in. twist drill, which I received with great joy. It was a most wonderful tool and attracted a great deal of attention as it was probably the only one of its kind in a radius of 20 miles from my home. The only kind of drill that had hitherto been known thereabouts was the flat drill, forged by the country blacksmiths to somewhere near the desired size.

With the product of my jig-saw I traded with neighboring farmers for broken down mowing machines, hay cutters, sewing machines, etc., in fact anything that had gears and wheels in it, until I had collected quite a treasure of what had once been machinery. The cash value of this junk was probably not worth considering but to me it represented vast wealth, as from it I could now build other machines and thus acquire experience and understanding of my chosen trade.

I Build a Steam Engine

Among the advertisements to be found in the *Scientific American* was one by Goodnow & Wightman of Boston, who would, for a consideration, undertake to supply amateur mechanics with a set of castings and other material from which to build a model steam engine. Seized with an intense desire to be the constructor of a steam engine that would really go, but too poor financially to purchase the bill of material, I eagerly studied these advertisements, pored over the pictures, digested all the reading matter that pertained to them, and decided to build an engine from my own junk pile.

With much labor and painstaking care, I proceeded to make the patterns for a slide valve engine of $1\frac{1}{2}$ in. bore by 2 in. stroke, including a fly-wheel with straight arms, for I did not like the looks of the crooked ones that were then thought necessary to avoid breakage in shrinkage. The molder, to whom I entrusted this pattern for casting, assured me that it would break but, much to his surprise and my gratification, it did not.

I knew nothing of cores as used in a mold and my cylinder was, therefore, cast solid. How to bore a $1\frac{1}{2}$ in. hole through this chunk of cast iron puzzled me not a little, but, by collaboration with the village blacksmith, we evolved a flat drill which he said was made of "sleigh shoe" steel (I guess it was, it wouldn't hold an edge) and with it I prepared to bore out that cylinder in my own lathe.

What Is a Mechanic?

By Charles W. Lee

Many people think of a mechanic as some sort of a low person who does something with his hands, even including digging the tradional post holes, made famous and immortal by good old "Chordal"; and of an engineer as some other sort of a low person who starts and stops a steam engine. From this point of view a mechanical engineer must be two low persons rolled into one, and therefore twice as disreputable as either alone.

This objectionable state of mind is well illustrated by the remark made by a beautiful lady at Old Point Comfort during a meeting there of the American Society of Mechanical Engineers. In answer to her inquiry she was told that the party was "The Mechanical Engineers."

"Mechanical Engineers! But they are quite respectable looking!"

Therefore the following definitions are proposed:

Mechanic: one who understands mechanical art.

Mechanical Engineer: one who solves mechanical problems.

It is true that the popular definition of "mechanic" has dictionary authority, but so have some other words which have more than one meaning, and even exactly opposite meanings, which makes confusion. Yet some other words have outgrown the dictionary, and why should not this one?

There should be a distinction between one who merely manipulates something with his hands, and another who knows what his hands are doing and why they are doing it. Manual dexterity should not be confused with mechanical knowledge any more than mechanical knowledge with scientific knowledge. There is nothing at all in this that is intended to belittle manual dexterity.

Science, which dreams and discovers; mechanical art, which applies science; and manual dexterity which finally makes it possible for the dreams of science to be realized, are all factors, and therefore equally necessary to the perfect whole—and accordingly equally honorable.

Friendly Competition

By A. W. Brown

While in some activities of life, competition is too sharp, a certain amount is good not merely for the community (which may be the shop, the nation, or the world) but for the competitors. Many a man has "found himself" only as the result of friendly competition with the man at his elbow, or in the shop across the street, or on the other side of the ocean. He discovers in himself and in things new sources of power and new methods of utilizing the old ones, and emerges from each contest more able and ready for the next.

Resistance Welding

The First Article—Methods of Welding—When a Flux Is Necessary—Current Required for Electric Welding—Principles of Electric Welding Apparatus

BY A. L. DE LEEUW
Consulting Editor, *American Machinist*

MODERN METHODS of welding have often been called the long-waited-for "putting-on" tool. This is particularly true of arc welding, autogenous welding and the Goldschmidt thermit process. In all of these processes metal is added to an existing piece, either to fill up a crack, to enlarge the piece at some point where the forging or casting made it too small or to form a bridge of metal joining two pieces. None of them is true welding. Resistance welding, on the other hand, does exactly what is accomplished by the blacksmith when he welds one piece to another. In books, 30 to 40 years old, one may find the statement that one of the qualities of iron is that it is not weldable. Brass or bronze or pure copper were not considered weldable.

What was meant by "weldable" was that certain materials could be brought, by heating, to a state of plasticity which made it possible to join them by pressure in much the same way that we can make two softened pieces of beeswax adhere to each other. No reasonable amount of pressure will join these pieces of wax when they are at the temperature of ice but as we gradually warm them they become softer until finally it is possible to unite them by slight pressure. They have become one in all respects. If we should try to separate them we would merely succeed in pulling the piece of wax apart and the probability would be that the break would not be where the joint was.

CONDITIONS OF WELDING

Any two materials which can be brought to this plastic state can be welded. The reason why wrought iron was weldable was that it could be brought to this plastic state. As a matter of fact, practically all metals can be brought to such a plastic state and if we wish to understand the possibilities and also the difficulties of resistance welding, we should first look into the question as to why one material can be welded so much more easily than another when both can be brought to the plastic state required for the operation.

In Fig. 1, a diagram is shown in which the temperatures are laid out on the horizontal scale. Going from

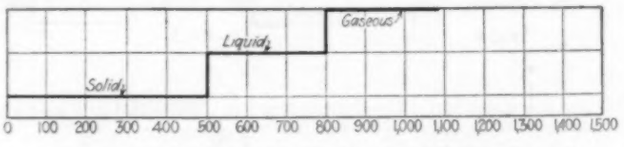


FIG. 1—DIAGRAM ILLUSTRATING RELATIONS OF TEMPERATURE AND CONDITION OF A METAL

left to right the temperature increases. Three stages are shown, one representing the solid state of the material, the second its fluid state and the third the point at which it evaporates or boils. Fig. 1 is entirely imaginary. We see that from 0 to 500 the material is in the solid state, at 500 it suddenly changes over to the liquid state, at 800 it suddenly changes to gas. Such sudden changes do not occur in reality.

Fig. 2 gives the diagram of the changes which take place in reality, though the figures are again imaginary. From 0 to 500 the metal remains in the solid state. From 500 to 1,000 it gradually changes, becomes less and less hard or, if we may say so, less solid until at 1,000 deg. it is completely liquid. It remains liquid from 1,000 to 1,300 when it begins to evaporate.

The range between 500 and 1,000 is the range of temperature with which we are mostly concerned when doing resistance welding. It is the range within which

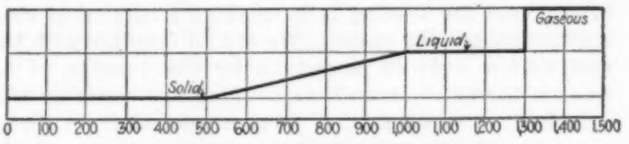


FIG. 2—DIAGRAM ILLUSTRATING THE GRADUAL CHANGING FROM SOLID TO LIQUID WITH RISING TEMPERATURE

the material is in the plastic state. It is very little plastic at 500, almost liquid near 1,000, and there are various degrees of plasticity between these two points. If we should have a material which is really in the plastic state between such wide limits as our diagram represents, that is between 500 and 1,000 deg., it would be very simple to weld two pieces together because even the crudest way of heating the piece would give us a sufficient time limit between the moments when it is entirely solid and when it is entirely liquid.

If, on the other hand, we should have a material which is entirely solid at 500 deg. and entirely liquid at 510 deg. it would be extremely difficult to weld two pieces together because we would have to catch the exact temperature between very narrow limits and thus work so exceedingly rapidly that the material would have no time to cool before the welding became complete. This is the reason why wrought iron and steel can easily be welded and why it is so difficult to weld copper, brass and various other materials.

THE OLD METHOD

When the blacksmith wanted to weld two pieces of wrought iron or steel together he would heat them to a point where the sparks began to fly, which was, to him, an indication that the metal was soft enough and far enough advanced in the plastic state, to permit the two pieces being joined by relatively light pressure, such pressure as could be given by hitting it with a hammer. Before actually applying this pressure he would put a flux on one of the pieces for the purpose of removing any oxide or other foreign material. He knew it was necessary that the pure, clean metallic surfaces should come in contact with each other. The flux was some material which, combining with these impurities, would become a liquid which could easily be squeezed out from between the two pieces to be welded.

The operations in resistance welding are very much the same as those of the blacksmith. In order to stay

as close as possible to the old process of the blacksmith, we will confine ourselves for the present to a form of resistance welding which is called "slow butt welding." In this process two pieces of metal are joined end to end. We will see later that there are also other methods of resistance welding. In the slow butt welding process the two pieces to be joined are heated until the plastic state is reached and then pressure is applied, joining them together. There is no flux used and the question of removing the oxides and other impurities must be solved some other way. The manner in which this is done is to melt off part of the material so that all the impurities will be removed with this molten metal and then to squeeze the two pieces together before the air can reach the new surfaces.

Resistance Welding

There are then, two things which we must accomplish if we wish to weld successfully. One is to bring the material to the proper heat and the other is to apply the pressure. The manner in which we obtain the proper heat for welding is by sending a current of electricity through the pieces. We are all familiar with the fact that a body is heated up by the passage of an electric current. Incandescent lights are based on this principle. The amount of heat developed is in direct proportion to the amount of power we send through the circuit. If for instance, we have a dynamo developing 100 kw., all of which is consumed by a system of wiring and a number of incandescent lamps, we know that there is enough heat developed in this system to absorb all of this 100 kw. Part of this amount may be used in the lamps themselves and another part in heating the wiring. If we have a great length of circuit, we can use only relatively few lamps because much of the power is consumed in the wiring itself. If, on the other hand, the circuit is short, we can have more lamps.

The amount of current which flows through a circuit depends on two items, the voltage supplied by the generator, battery or transformer and the resistance of the circuit. If we have a generator or battery or transformer which supplies current at 110 volts and which is so regulated that it will always deliver this voltage regardless of other conditions, then the amount of current will depend directly on the resistance. If, for instance, we had a 1,000-kw. generator furnishing current at 110 volts and if we had a short line with only two 50-watt lamps in it, the amount of current delivered by this generator would be only 100 watts or $\frac{1}{10}$ kw. notwithstanding the fact that it could deliver 1,000 kw.

Amount of Current

In most applications of electricity, with which we are familiar, voltages and resistances are rather high and the amount of current rather low. In resistance welding the opposite is the case. Here the resistance is very low and so is the voltage, while the amount of current is very high.

Various pieces of work may require various amounts of current but their resistance may be such that they would receive an entirely different amount from what they need if the voltage were always the same. In order then, to be able to furnish as much current as is required and no more nor less it is necessary to have a variable voltage. The simplest way of obtaining such variable voltage is by the use of a transformer with an alternating current circuit. Without going into reasons why a transformer is able to do so, we may say here that this piece of apparatus can give any voltage required when the current which leads into it has one fixed voltage. For instance, we can lead a 440-volt current into a transformer and take from it a current at 220, 110, 55, or even 1 volt. Moreover, we might have gone the other way and taken the current from the machine at 880 or 2,200 volts.

The general construction of such a transformer is two sets of copper windings around one and the same iron core. The current coming from the generator is led in around the iron core and out again back to the generator and is known as the primary current. The secondary current is that current which we take from the apparatus. The winding for the secondary current has more or less turns around the core than that for the primary one, according to whether we wish to step the voltage up or down. If the primary winding has 10 turns around the core and the secondary winding has 100 turns, then the secondary voltage will be ten times as great as the primary. If, on the other hand, the primary winding has more turns than the secondary, we will have a reduced voltage. Suppose we should have 10 windings on the secondary current and suppose that this will give us 10 volts. Then, if we should tap our wiring not at the end of the 10th winding but the end of the 9th we would get only 9 volts and if we should tap it at the end of the 2nd winding we would get only 2 volts. This shows how it is possible to get any voltage from an alternating current circuit.

Making the Contact

The resistance welding machine consists of a transformer with means to tap the secondary circuit at various points and so obtain varying voltages. As the amount of current will be very great the secondary winding must be made of heavy copper wire or bars. As the voltage of this secondary winding is very low all the joints of the wiring must be made perfect so as not to have a loss of voltage by imperfect contact.

The work to be heated is held between two copper electrodes. As these electrodes must be shaped to suit conditions and shape of the work, they are generally called dies. There are then, two pairs of dies, each pair gripping one of the pieces to be welded together.

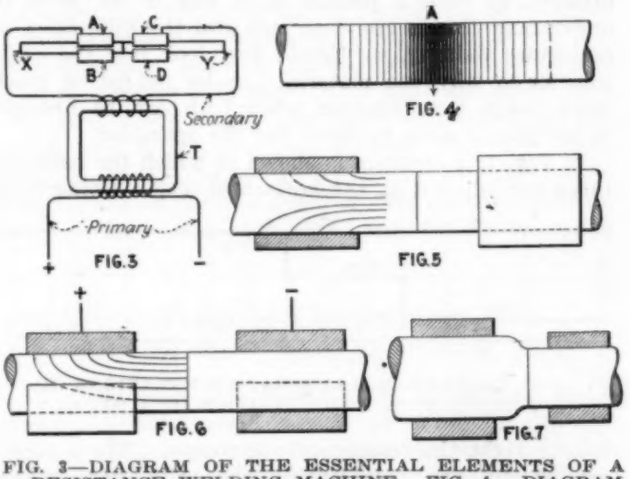


FIG. 3—DIAGRAM OF THE ESSENTIAL ELEMENTS OF A RESISTANCE WELDING MACHINE. FIG. 4—DIAGRAM SHOWING JOINT DISTRIBUTION OF HEAT WHEN TWO PIECES ARE BROUGHT TOGETHER IN WELDING MACHINE. FIG. 5—DIAGRAM SHOWING PATH OF CURRENT WHEN PIECES ARE SURROUNDED BY DIES. FIG. 6—DIAGRAM SHOWING UNEQUAL RESISTANCE WITH ONE FLAT AND ONE CURVED DIE. FIG. 7—TWO PIECES OF UNEQUAL DIAMETERS HELD IN WELDING MACHINE.

One pair of dies is stationary, the other can be moved by means of a lever or some other mechanism. In the case of very heavy welding, hydraulic cylinders are used to supply the required pressure.

When a piece of work is gripped in each of the two pairs of dies and the switch is thrown in so as to permit the current to flow through, nothing will happen until the two pieces of work are brought together because the circuit is not closed. As soon as the two pieces of work touch, this circuit is complete and the current will flow through, heating the pieces. It might be asked whether the entire apparatus is not going to be heated and where the greatest heat will be developed.

Elements of Machine

In Fig. 3 the elements of a resistance welding machine are shown in diagrammatic form. T is the transformer core with its primary and secondary windings; A and B is one set of dies; C and D the other set; the two pieces to be welded are marked X and Y. They are shown here to be in contact with each other so that the current will flow from the transformer through A, through X, then through Y and C and back to the transformer. In reality the windings are not wires as shown in the diagram but heavy cables, or, where this wiring is attached to the movable parts of the machine it may be a set of copper leaves which will permit their movement. In either case the resistance of the wiring is very small. In fact, the total resistance of the circuit is small so that the amount of current which will flow through it is very great, notwithstanding that the voltage used is low.

When the current flows through this system, the two pieces X and Y will be heated at the joint and the question naturally arises why this should be so. To the man who is not daily considering electrical problems it may be confusing to hear one moment that the amount of current is very great because the resistance is low and the next moment that the greatest amount of heat is developed at the joint because that is where the resistance is greatest. The matter is very simple, however, if one gives it a minute's thought. The amount of current flowing through the entire system is great because the resistance of this entire system is small. If the voltage is indicated by V, the resistance by R and the current by C, the relation $C = \frac{V}{R}$ exists. If once the voltage is fixed, the amount of current will depend directly on the amount of resistance so that with the two pieces in place a certain amount of current will flow through the system, depending on the total amount of resistance of the wiring, the dies and the pieces to be welded.

Theory of Heating

If, in any circuit, there is a certain amount of current flowing, then this current will heat up all parts of the system but not, necessarily, equally. We know that the amount of power consumed anywhere in the system equals the product of the voltage and the amount of current. Power $= CV$, and as $V = CR$, we find that the amount of power consumed in any part of the system is C^2R. Now the amount of current, that is C, is fixed by the total resistance of the system and we see that the greatest amount of power is consumed and therefore the greatest amount of heat is developed at that part of the system where R is the greatest. Come to consider it, we really were familiar with this fact. The reason why the filament of the incandescent lamp is heated, whereas the insulated wire leading up to it remains cool, is simply that the resistance of this filament is many times that of the copper wire.

Knowing these elementary facts, we can now readily understand why the heating will start at the joint of the two pieces X and Y. This joint is imperfect. Even though we may press Y against X the contact between the two pieces can never give the same conductivity as that of a solid piece of material. It is at this joint then that the heating of the system starts. The heating continues and spreads backward, somewhat as illustrated in the diagram, Fig. 4, with the joint of two pieces as shown at A and with the amount of heat developed as represented by heavier and lighter lines. It will be noticed that the pieces are gripped in copper dies. These dies have a broad contact with the pieces, have a large exposed area and, as a rule, are water cooled so that the heat of the pieces is rapidly carried off by them.

Figure 4 shows the two pieces bearing squarely against each other so that the resistance is the same at any point of the cross-section. As a consequence, the same amount of heat will be developed at all points of the joint. If the pieces were not square or if their axes were making an angle with each other there would be a pointed contact, or at least, a contact over very limited surfaces. The resistance would be maximum at that point and the heating would start there. Unless we do something to counteract this effect, the metal at that point will melt. Such conditions must be avoided.

Ideal Welding Conditions

With heating, such as shown in Fig. 4, we have ideal conditions for the making of a perfect weld. The metal at the joint will gradually become hot enough to melt. Immediately behind this zone there will be a layer of metal close to the melting point, but still solid. Further back there is metal which is perhaps not plastic enough to be suitable for welding but soft enough to be easily compressed. Still further back the metal may be hot but hard enough so that it cannot be deformed by the pressure brought to bear when we make the weld.

The relative thickness of these layers is affected by quite a variety of things. For instance, if the dies have a broad grip on the piece and are water cooled, the heat will be carried off so rapidly that only a very short piece of the metal is heated. Even at that, the heating depends on the amount of projection of the piece beyond the die. If a long piece should be projecting, the heat would have to traverse this long piece before it would reach the die so that there would be a large amount of metal in the molten or plastic state. This would be still further aggravated if the projecting piece were of small diameter because the resistance would increase and therefore the amount of heat developed and the rapidity with which the heat can be carried off would be reduced because the cross-section along which the heat would have to flow is very small.

The manner is which the piece is gripped by the dies is also a factor determining in what manner the piece will be heated. In Fig. 5, the pieces are shown as held in solid copper bushings which, by the way, is not the way we would do it in practice. There is here a perfect, even grip all around the piece and as a result the current flows in a perfectly even manner from the dies through the cross-section of the piece toward the joint. In Fig. 6, another extreme is shown. In this case there

is a flat top die, making a line contact with the piece, while the bottom die reaches about half way around the piece. Here the current, which enters the top die only, must flow along a path of varying length to reach the various different points of the joint. As the lengths of these various paths are unequal there is an unequal resistance to overcome so that, in this case, we would find that the pieces are heated more at the top than at the bottom, notwithstanding that they bear squarely against each other.

There is still another item to be considered. The resistance of the material changes as it is being heated. It becomes greater. If the pieces are heated at one point, due to some defect in the bearing or distribution of the current, the resistance at that point will be increased. Consequently, the heating effect at that point will be still further increased.

If pieces of uneven diameter should be pressed against each other, see Fig. 7, the following will occur: The heat developed at the joint has, of course, a tendency to warm up both sides of metal but this heat will be carried away on the left side by a much larger section and larger dies, both pieces of steel and die having a larger radiating surface. As a result the metal will all melt away on the right side, whereas that on the left side will remain relatively cool.

Resistance Altered by Heat

Assembling the various points discussed so far, we see that the heat developed depends, in the first place, on the voltage; in the second place, on the resistance of the entire circuit; in the third place, on the nature of the contact between dies and pieces; in the fourth place, on the way in which the dies are cooled; in the fifth place, on the manner in which the two pieces make contact with each other; in the sixth place, on the amount of projection beyond the die, and finally, on the cross-sections.

It would seem as if, with so many variable elements, it would be extremely difficult to get conditions right for the making of a weld but this is not at all the case. Due to the fact that there is such a wide temperature range within which welding can be made, the fact that there are so many elements helps us in many cases for if conditions are unfavorable in one respect there are several elements within our control which we can modify so as to make conditions right in some other respect.

We will now see how the foregoing can be applied to the making of welds. A great many names are given to various combinations of pieces to be welded and to the various processes to effect such welds. The main processes are these:

Slow butt welding (sometimes called "up-set" welding).
Flash butt welding.
Spot welding.
Seam welding.

Feed Pressure of a Twist Drill

By R. Poliakoff

In the Sept. 28 issue of the *American Machinist*, p. 480, A. L. De Leeuw, in his article on "Methods of Machine Tool Design," while speaking about feed pressures says, "In a drill press the feed pressure depends on two items, both of which are rather undetermined at the present time. Using a twist drill, we find two elements requiring feed pressure. One is the penetration of the lip into the material, the other the penetration of the bridge or web between the lips. This latter item is entirely undetermined and may be very great. The first item resembles to a certain extent the pressure required to feed a lathe tool into the work."

Extensive experiments have been made in 1907 by the writer and Mr. Dempster Smith of the Manchester School of Technology in Manchester, England, for the very purpose of determining the feed pressures of a *high speed* twist drill when working on different metals under different conditions and also the two items of same—one due to the lips and the other due to the web. These experiments were made the subject of an extensive paper read before the Institution of Mechanical Engineers in March, 1909 and, while it would be out of place to go into the details of these tests and all the results of the same, those interested may consult the "Proceedings of the Institution of Mechanical Engineers," London, 1909, pp. 315-415.

I may mention here that those tests have shown that the web is accountable for about 20 per cent of the total end or feed thrust. To be more specific, it was found that in case of soft cast iron, the pressure P can be expressed by the equation

$$P = 35{,}500\ d^{0.7}\ t^{0.75}$$

If we eliminate the effect of the web, the pressure would be

$$P = 12{,}600\ d^{0.7}\ t^{0.6}$$

or about 25 per cent less. This difference increases with the feed, (d is the diameter of the drill and t the feed).

In case of medium steel, respective equations are

$$P = 35{,}500\ d^{0.7}\ t^{0.6}$$

$$P = 27{,}000\ d^{0.73}\ t^{0.6}$$

In this case, the thrust due to the web is about 21 per cent of the whole drill.

Unnecessary Interruptions

By Frank V. Faulhaber

"This is what I call a machine shop of half-way jobs," is the way an employee recently explained it, after he had been taken away from one job, uncompleted, to start another. "There are so many things to do here that you don't often have the time to finish a given job from beginning to end."

Where this practice is existent the men in charge do not realize how much valuable time is being wasted in the process. For one thing, there is always the time in between two different jobs, however little, that is lost. And we have noticed in certain machine shops where it is customary to take a man from one job and start him to work completing another, that much unnecessary additional work is involved, since the second man must find out what the first one had been doing, entailing the asking of questions and other details, which would not have been necessary had the first man finished his task.

In this connection, one executive recently gave the advice: "Never take a man away from a job unfinished, if you can possibly avoid it, and do not interrupt him during a job. If you have something to tell him, wait until the job is done, otherwise you are taking his mind away from his work."

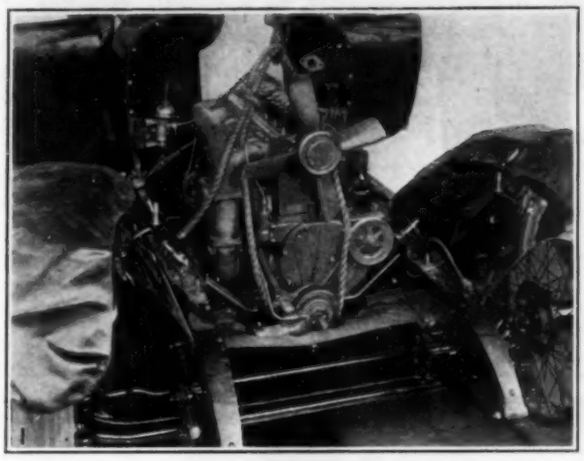
This is true talk. The man who is interested in his job resents interruptions while he is busy, even from the boss himself.

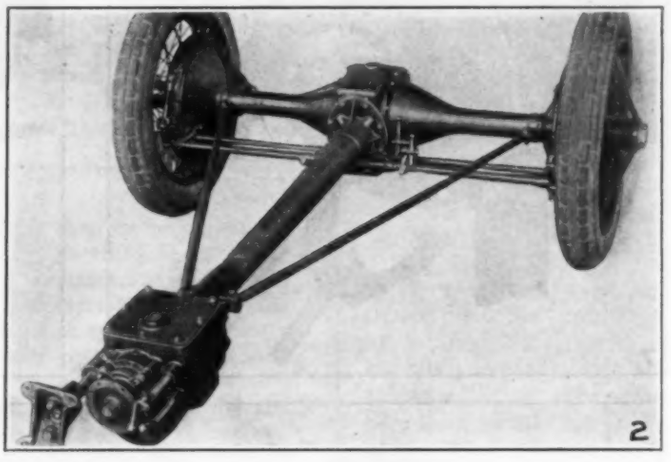
Disassembling the Marmon for Repair Work

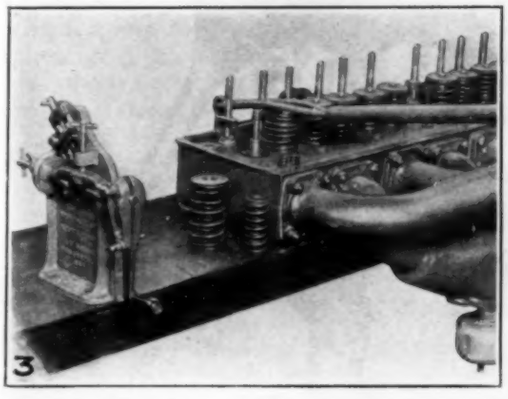
Twelve Steps in Handling Cars in the Service Station—Caring for the Motor, Transmission and Rear End Units

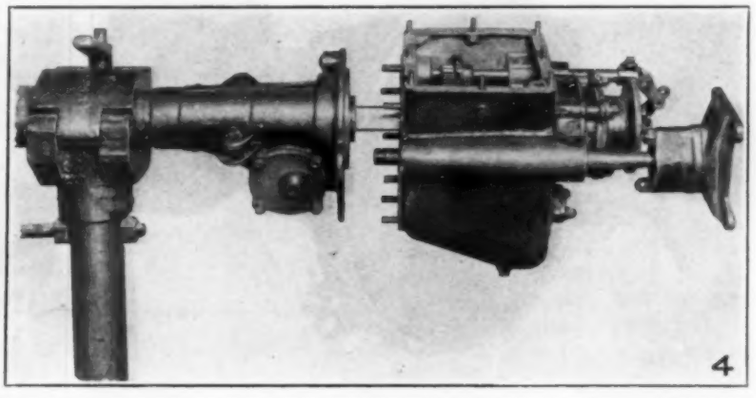
By FRED H. COLVIN
Editor, *American Machinist*

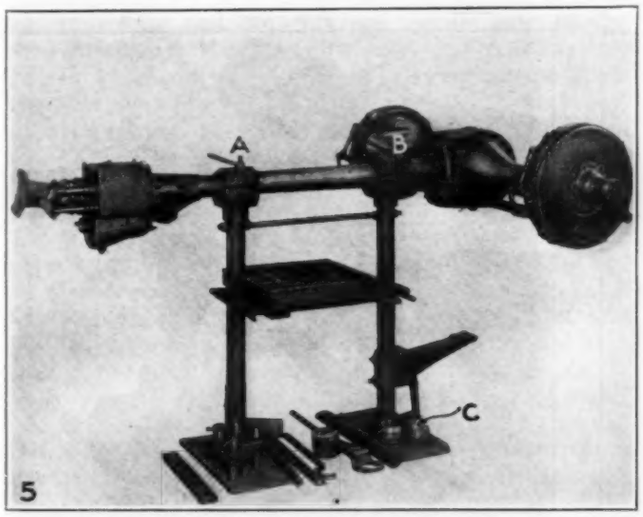
ECONOMICAL repairs are being considered more and more by buyers of automobiles and, as the cost of overhauling depends somewhat on the time required for dis-assembling, the following suggestions may be of service to all service station men, although they apply especially to the Marmon cars. First of all, it would seem natural to protect fenders, as in Fig. 1, but too few take the trouble. The main object of this view, however, is to show how to handle the engine quickly and safely. Valve facing is shown in Fig. 3 while











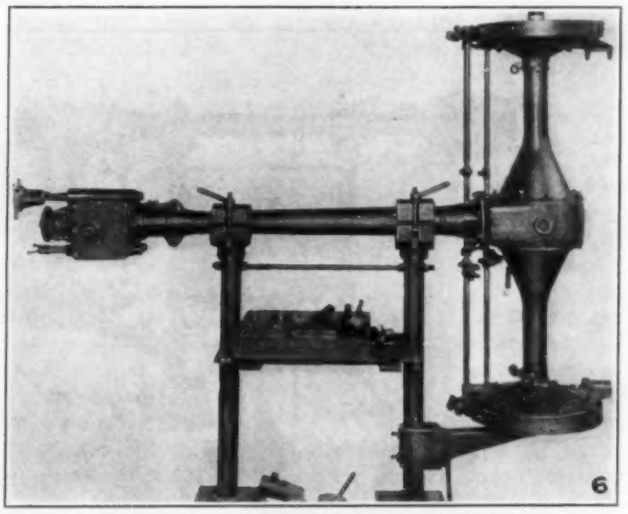
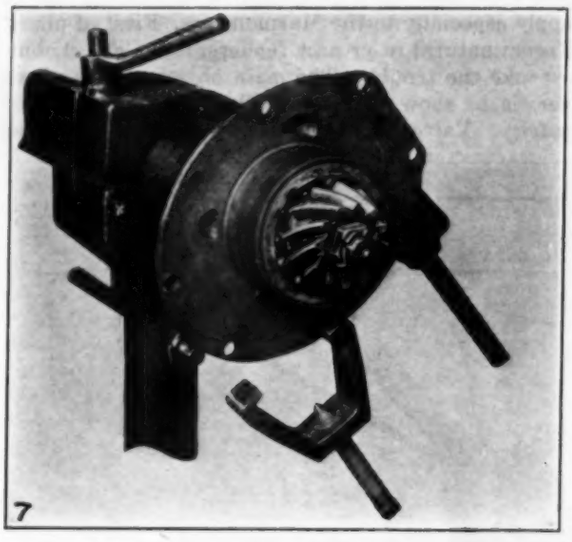


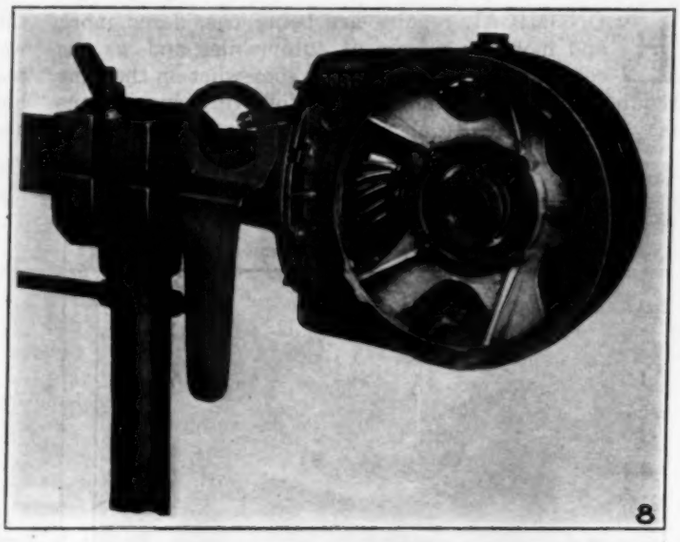
FIG. 1—METHOD OF SLINGING MOTOR FOR HOISTING. FIG. 2—REAR END UNIT REMOVED FROM CAR. FIG. 3—TAKING OUT VALVES AND TRUING THE SEATS. FIG. 4—PULLING OUT THE TRANSMISSION CASE. FIG. 5—WORKSTAND FOR REAR END; CLAMPS AT A, B AND C. FIG. 6—AXLE SWUNG UP ONTO SUPPORT

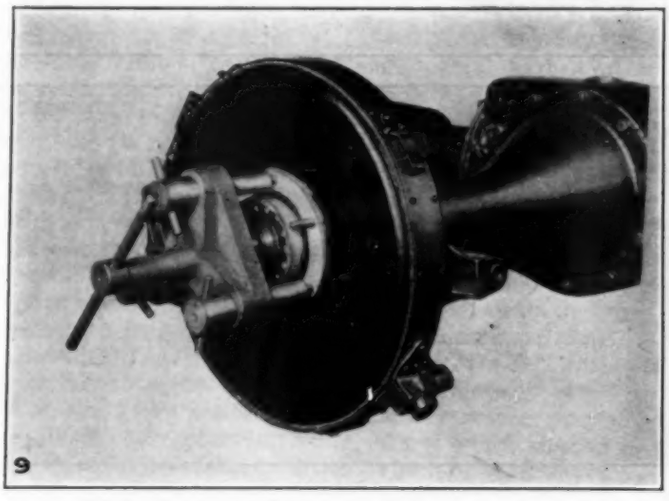
Figs. 2, 4, 5 and 6 show the stand used for handling the rear axle assembly with the work in different positions.

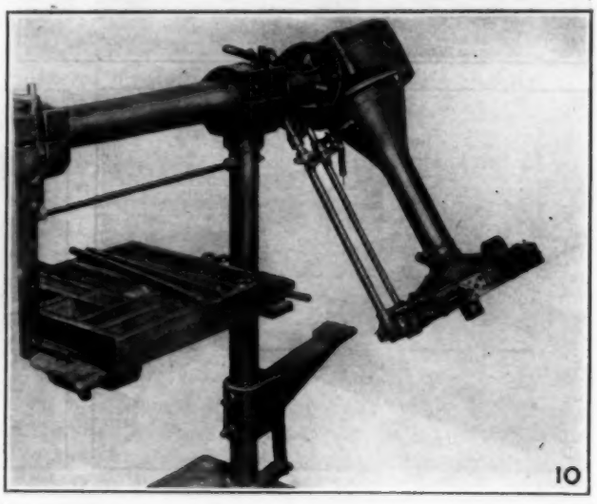
The driving pinion and the puller for removing it are shown in Fig. 7 while Fig. 8 shows the differential case in place. Another puller, having three legs in this case, is shown in Fig. 9. These legs screw on the ends of the studs and act on the ball bearing shown.

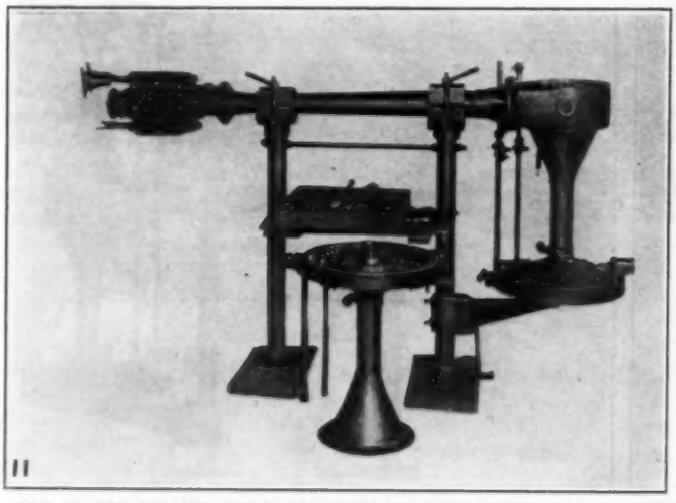
Figures 10 and 11 show a convenient form of stand for transmission work, the step acting as a support for the brake drum. Tools and small parts are kept in the tray on the stand within easy reach. More details are shown in Fig. 12, where the housing has been removed, exposing the inner roller bearing. All these and similar devices help reduce the cost of overhauling a car and keeping it in good shape during its life.











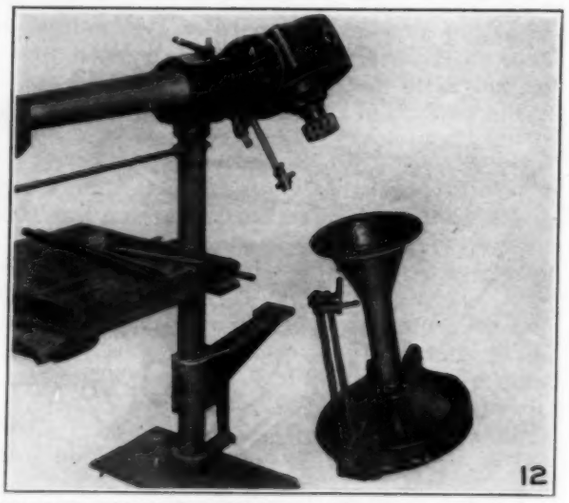


FIG. 7—READY TO PULL THE DRIVING PINION. FIG. 8—DIFFERENTIAL UNIT WITH AXLE HOUSINGS REMOVED. FIG. 9—PULLING THE REAR-AXLE BALL BEARINGS. FIG. 10—REAR AXLE PARTLY DISASSEMBLED. FIG. 11—SHOWING CONVENIENCE OF WORK STAND. FIG. 12—AXLE HOUSING REMOVED SHOWING INNER BEARING

Industrial Cost Accounting for Executives

Introductory Chapter Outlines Whole Problem to Be Treated in Series—Subject Matter Based on Experience in Many Plants—Purpose of Series

By Paul M. Atkins

WHEN a busy factory executive finds himself confronted with a series of articles on a subject like cost-accounting, he is properly desirous of knowing what he may expect from spending his time reading them. It has also been proved frequently that it is much easier to solve a problem when one has had a general view of it than when one begins at once with some detail and endeavors to work out its solution. For these reasons, I feel that it would be most helpful to the reader to give him a brief survey of what is to follow in the succeeding articles of this series. In this way he can see if they seem to hold for him what will be of value to him. If he decides in the affirmative he can get an idea of their organization and be prepared to fit into their proper places the various details as they are developed.

In the first place, these articles have been written with the idea that cost-accounting is essentially a part of the factory records and is a means of representing, in terms of dollars and cents, what goes on in the factory. No one, not familiar with the work of the factory, is properly equipped to install or operate a cost-accounting system. At the same time, no one is properly trained for this task unless he also knows something about general accounting methods. The cost accounts must tie in with the financial accounts, while the controlling cost accounts are usually kept in the general ledger. Hence, if the cost accountant is not trained in the fundamentals of accounting, he finds himself almost hopelessly handicapped for his task.

This explains the reason why so many cost accountants fail. They lack experience in one or the other of the two phases of their work. It also explains why so often we find professional accountants and practical shop men and engineers at logger-heads over the cost records and the way they shall be kept. Both sides are right in feeling that the cost accountant should know something about their approach to the problem and both are wrong in thinking that their side is the only one or the most important one. Cost-accounting is really a bridge between the factory and the general accounts and it needs to be firmly anchored at both ends. The effort is made in these articles to keep both points of view in mind and show their relationship to each other.

With this brief sketch of the approach which these articles make to the subject of cost-accounting, let us now turn to a consideration of their contents. It is planned to have thirty of them altogether and they fall quite naturally into seven groups. After outlining the several groups, we will briefly glance at the topics to be treated in the individual articles.

In the first of these groups some preliminary topics are discussed. Some of them, like the organization of the company, may seem at first glance rather out of place, but later on it will be evident to every careful reader why it was brought in. The second group deals with the question of material, and explains the control of material in all the various effects which it has on the cost records. The next section does the same for labor.

The fourth group takes up the problem of expenses. Often there are difficulties of a practical nature in handling expenses but the troubles of a theoretical sort have usually been magnified. The effort is made in these chapters to present the subject in such a way that the fundamentals of expense records may be easily grasped.

The fifth section leads us to a consideration of burden, as to what it is and how it should be applied to the product. It will be seen that all expenses are not a part of the manufacturing burden and that all of that burden is not always properly chargeable to the product. Several methods of burden application will be explained, in particular one which is especially applicable to metal-working industries.

In the sixth division, the method of finding the cost of the product is taken up. In addition, some pertinent suggestions for the operation of the cost department are offered. In the last group the interlocking of the cost-accounting with both production and the general accounts is explained in the light of what has been said in previous articles. Certain cost records, which do not form an integral part of the cost accounts but which are of great use to the management, are developed.

In all these chapters, sound theory is not sacrificed to expediency and, at the same time, impossible and useless methods are not presented. The articles will be illustrated by methods which I have personally tested out in actual practice, and, while that does not mean that they would be satisfactory for all occasions, it does mean that they have all survived the test of actual application. Sound practice can only be based on sound theory and sound theory can only be developed by the study of actual experience and careful analysis of the results.

THE FIELD of cost accounting has long been an industrial battle ground. The professional cost accountant, with little knowledge of actual production methods, has advanced one point of view, the engineer another, and the factory cost accountant still another.

Between these various fires the bewildered manager has had to conduct the business, pulled this way by one partisan, that way by another. Unfortunately his knowledge of the subject is usually insufficient to enable him to judge accurately the value of the various claims and theories presented to him. Most books on cost accounting are too technical for him and presuppose an acquaintance with accounting methods which he may not have.

With the executive's predicament in mind, this series by an expert on cost accounting is presented with confidence that it will fill a long-felt want.

The foregoing gives a brief synopsis of the following articles but for those who would like a little more detailed information the remainder of this article will be taken up with a hurried survey of the individual chapters. Such a survey will serve to amplify the outline which has already been given and will make clearer the reason why certain topics have been included.

In the article which follows this one and is entitled, "Executive Uses for Cost Records," an outline is given of the possible uses of cost records, particularly to the executive. It is an article which is prepared on the same lines as this one in that I try to point out some of the ways in which cost records may be utilized to benefit the management and so indicate why it is worth while reading about cost systems at all.

In the good old days, the man was considered a good salesman who could slip something over on his customers and get away with it. He was thought of as a sharp, shrewd trader and a good business man. Now we are coming to realize that sharp practice is not worth while, but that it is better business to give our customers their money's worth. I am trying to follow out this latter idea in what follows and explain to my readers in these first two articles just what they may expect these articles to contain and what they may hope to find in the way of benefits to be obtained from a cost system. Of course, all I can attempt to give here are some samples, or better, a description of my goods, but I hope that from this the reader can decide whether or not he wants more, and, if what I have to offer in these articles is what he wants or needs, I am quite hopeful that he will not be disappointed.

A Survey of Cost Elements, Records and Relationships

In the third article, I shall try to make plain the various elements of manufacturing cost. On the face of it, it may appear simple. Material, labor and burden are commonly accepted as these elements. The difficulty comes when one tries to define these elements in a useable and practical fashion. It is necessary to obtain such definition before undertaking any discussion of industrial cost-accounting. In the fourth article comes a summary of the cost accounts and journals by means of which the cost records are kept. The details of this summary are included in later articles.

The next two articles are likely to seem quite misplaced for they deal with the functions of a business and their organization. Yet fundamentally expenses are nothing more nor less than the costs of carrying on the various departments of the business, and hence it is quite impossible to understand either the recording or distribution of expenses unless the significance of the various departments and their interrelationship to form an organization is realized. The second of these articles takes up the question of an organization manual.

In the following article, a topic is taken up which is seldom touched on by writers on cost-accounting in any adequate fashion. This topic is the service of the production control system to the cost-accounting system. Yet a good system of production control is almost always a prerequisite to satisfactory cost records. By far the larger part of the mass of details which the cost department must handle comes from the planning department, and the aid which a good planning department can give to satisfactory cost-accounting is incalculable.

The next three articles deal with the records for material. Since the cost records for material come from the production system, it is necessary in one of these articles to trace the control of material till it enters the cost system. Another article is devoted to the problem of the accurate pricing of material withdrawn from the store-room. This seems like a very simple little problem and yet it is one of the places where some of the most serious errors in the cost records are made. Three methods are explained for dealing with the problem. The last article takes up the question of maintaining correct inventory balances and explains a simple but practical method for accomplishing it.

Only one article is given to a discussion of the payroll and the details which are needed to make it up. There are two points somewhat out of the ordinary in this article which it may be appropriate to mention. One is the emphasis laid on the cost of wages calculation as a factor in selecting a method of wage payment. The other is the use of a labor journal to meet the needs of a factory where there is an extensive and constant shifting of workers from one task to another.

Expenses

The next article will deal with the question of expense classification and also will take up the scheduling of budgeting of expenses. It serves as an introduction to several articles on expenses. The following one will give an outline of a typical symbolized expense classification. It is the result of much experience and should serve as a guide for anyone who is faced with the problem of preparing a similar classification. The next article is devoted to a discussion of depreciation and other fixed charges, charges which are a vital matter to the manager for they continue to run along whether business is dull or brisk and cannot be stopped by shutting down the factory.

There will then follow two articles dealing with current expenses, one given up to a discussion of manufacturing expenses both direct and auxiliary and the second to administration and selling expenses. After them will come an article in which a satisfactory method for the recording of all these various expenses will be explained. It will be found that a good many expense accounts will be suggested as desirable in order to permit the necessary analyses of expenses and if such accounts are set up in the ordinary fashion, they will be much too cumbersome.

Interest and Cost

The eighteenth article will be devoted to a summary of the pros and cons in regard to the desirability of including interest as an element of cost. I shall try to make clear that this question is not so serious as it is often supposed to be and to indicate a reasonable attitude to take toward the whole problem.

The succeeding article will take up the question of the distribution of expenses so as to obtain the departmental burden. This is a topic which presents serious difficulties and is usually side-stepped by most writers on cost accounting by saying that it should be done on some *appropriate* basis and then they forget, with hardly an exception, to state what the appropriate basis is. Two practical methods will be presented. They are not ideal; they are not entirely satisfactory; but they will work, for they have worked.

We have now reached the articles dealing with bur-

den. The first will be given up to a discussion of what burden is, the difference between earned and unearned burden and how the unearned burden may be disposed of. The next two will take up several different methods of allocating the earned burden to the product. The machine rate method which is of especial interest to metal-working industries will be developed with particular care.

The Operation of the Cost Department

In the article on the recording of costs which now follows, not only will methods for recording the cost of the product be discussed, but also the improvements which the company may make for itself from time to time. All too frequently, this rather significant detail is overlooked and it is of particular importance to those industries which are using and often making large quantities of tools.

The twenty-fourth article will discuss certain aids to efficient and rapid cost recording, including not only machines of several kinds but also standard practice instructions for controlling the work of the department. The following article will contain a sample of standard practice instruction which may serve as a guide to those who wish to prepare similar instructions, the value of which cannot be realized until they are tried.

The Utilization of the Cost Records

The next article will deal with the tie-in between the cost accounts and the general accounts. It will follow the same outline as the earlier chapter on much the same topic but it will be written with the idea in mind that the reader has read the intervening articles, and so will be ready for this more rigorous treatment of the topic.

The following two articles will present some of the cost statistics which do not ordinarily form a part of the regular cost accounts but may be obtained from them, as well as the uses of these statistics and the cost accounts as an aid in production control. The relationship of the cost department and the planning department is not one-sided, but reciprocal.

In next to the last article will be given a brief but comprehensive selected bibliography of books on cost-accounting so that the reader who wishes to study the subject more intensively may be guided in his efforts. At the end of the series will come a concluding article.

This, in brief, is what I plan to cover in this series of articles on cost-accounting. I hope that my readers may obtain therefrom assistance and guidance in solving their problems. Good, well-fitting cost-accounting systems do not come ready-made. They must be tailored to fit. I have no expectation that the methods which I shall outline in these articles could be adopted without any alteration by any company, but to the intelligent man who is not entirely acquainted with this subject, they should bring fruitful suggestions.

Grinding Off Stock

By John Mark May

The article, Grinding Off Stock, by Entropy on page 552 of the *American Machinist* brings to mind another axe factory that, about twenty-five years ago, was doing a profitable business, one as large as their power supply would permit. They used water-power and used all that was furnished by the stream upon whose bank they were located. This company operated less steadily from year to year and with an ever-decreasing number of employees for a period of about ten years. At that time they closed their doors.

There was difficulty experienced in getting the operators to use improved methods but there is some grounds for the belief that the management could not foresee any advantage in adopting improved methods. They allowed matters to drift along until their business had gone to such an extent that very radical changes were needed. Then they found that the men, having worked so long without any changes, seemed to have lost any progressive spirit that may have been present at an earlier period. Had the management in this case and perhaps in the case described by Entropy been believers in evolution, as far as manufacturing processes are concerned, it is possible that the one might still be in business and the other more prosperous than they now are.

I cannot quite agree with Entropy that the solution of the problem, as far as the manufacturing problem applies, lies in the employment of younger men who have no precedents to break down. I would suggest, however, that, instead of changing directly to the wheel that was soft enough to do the work satisfactorily, a very gradual change be made by using wheels that are only the least bit softer for the first change, believing that the vast majority of men would soon adapt themselves to bearing on slightly less. When this has been accomplished, succeeding steps can be taken until the desired results are obtained. The advantages would be derived from the experience of the older men who remained, as Entropy has pointed out.

The Desire to Create

By Elam Whitney

One of the factors in securing the greatest efficiency among employees and one little recognized by welfare managers is the desire to create. This desire is evidenced in the discontent of a tracer who wants a chance at drawing as well as the discontented machine operator who wants to be transferred to the tool making department. It is quite often the cause of so-called government work in the various machine shops and wood making departments, the wasting of employers' time while the employee is making parts for some device of his own. This practice is not so common among employees who are engaged in creative work and are made to feel that they are a part of the factory organization and not merely one of the machines.

This creative desire is not always the cause of the employee working on devices of his own, as is evidenced by the great amount of automobile repairing, nickel-plating, etc., being done on the companies' time. This practice is often caused because of the example set by the foreman in doing these same things himself. There is one large concern which has been very successful and at the same time has almost ignored this desire to create. But they have compensated to a great extent by establishing a minimum wage. Excellent results will follow a careful checking up of employees' ambitions and careful guidance and development along the line of greatest benefit to employer and employee alike.

United States—Exports of Metal Working Machinery

Period—1909 to 1921, Inclusive

Country	1909	1910	1911	1912	1913	Annual Average for 5 Years	1914	1915	1916	1917	Fiscal Year 1918	July 1st to Dec. 31st 1918	1919	1920	1921
Germany	$943,119	$1,804,682	$2,523,735	$2,953,361	$3,175,188	$2,280,017	$2,167,240	$ 121,756	$	$	$	$	$ 8,746	$ 144,192	$ 118,393
England	907,199	1,315,903	2,268,169	2,581,682	3,209,559	2,056,502	2,988,684	11,842,842	19,925,934	15,835,434	17,537,334	9,588,126	14,960,613	10,760,957	2,545,393
France	307,145	691,480	962,890	1,267,831	1,936,908	1,033,251	1,771,525	8,695,826	13,316,702	29,254,379	20,270,530	6,331,391	15,785,280	7,595,733	3,924,361
Canada	214,029	336,172	766,127	1,362,326	2,326,270	1,000,985	1,199,356	1,813,188	6,464,332	7,780,396	3,751,327	3,072,263	4,034,646	5,815,314	1,218,012
Russia in Europe	71,655	234,776	389,330	547,752	1,088,751	466,453	1,333,644	2,123,195	10,280,566	12,587,938	1,918,405	942	87,677	178,270	1,179
Belgium	154,470	162,529	397,157	646,541	786,679	429,475	552,531	35,416	.....	.....	.....	420	3,882,163	1,920,172	662,127
Austria-Hungary	225,198	175,525	237,152	398,804	600,593	327,454	268,010	24,256	.....	.....	.....	.....	4,939	5,782	.....
Italy	93,653	134,583	351,271	273,344	437,910	258,152	421,603	511,134	4,779,178	8,771,496	5,076,878	1,129,845	1,892,070	1,488,818	239,270
Australia and Tasmania	94,184	138,392	281,979	349,638	406,093	254,057	1,316,952	282,487	800,825	664,264	400,068	255,302	669,591	885,490	490,977
Brasil	23,063	19,657	128,454	331,422	346,187	169,757	115,974	55,106	29,606	55,409	164,587	110,913	616,396	455,184	726,228
Sweden	23,472	98,673	138,748	166,977	241,373	133,849	310,613	621,458	204,840	313,044	96,737	.....	842,019	446,787	109,806
Netherlands	23,700	70,855	139,407	143,528	260,893	127,677	186,756	79,403	331,559	436,128	23,580	.....	668,046	361,024	153,961
Argentina	72,871	237,123	88,155	117,061	112,747	125,591	109,836	25,700	142,907	154,581	166,041	66,385	442,660	551,407	351,143
Japan	41,555	87,160	236,733	133,546	119,558	123,710	120,166	86,166	437,159	1,092,317	2,525,276	2,254,151	5,383,184	4,250,583	2,636,018
Mexico	175,403	84,892	160,027	46,977	83,259	110,112	74,706	37,530	103,083	97,631	314,534	92,178	319,719	610,572	748,894
Scotland	44,627	45,428	50,836	97,313	201,584	87,958	185,649	449,470	509,000	461,489	858,194	243,804	249,267	238,140	152,928
Cuba	10,295	42,072	66,470	89,900	124,669	66,681	146,596	100,507	151,886	334,512	278,698	171,820	737,238	1,218,869	575,683
Spain	23,202	36,340	53,970	62,536	109,624	57,134	111,686	98,693	776,495	1,686,392	1,252,525	89,471	1,282,204	1,144,844	369,031
Norway	10,769	34,133	44,576	91,332	79,366	52,035	92,729	211,640	233,931	356,514	121,018	248,687	470,843	158,200	29,452
Denmark	15,905	12,486	39,424	59,025	84,753	42,319	48,204	247,244	86,797	338,920	21,652	10,653	439,109	234,491	31,771
New Zealand	11,175	15,114	39,131	46,958	54,732	33,422	36,260	21,679	68,926	67,192	56,731	27,136	123,399	198,261	119,695
Chile	112	29,302	24,649	59,662	43,930	31,531	85,168	28,430	58,447	426,980	792,882	230,181	677,018	443,379	254,768
British India	19,088	45,765	20,162	28,281	43,717	31,403	17,953	23,700	52,225	273,744	1,271,698	561,287	900,429	1,374,068	1,422,184
Panama	41,732	34,919	17,031	9,923	10,886	22,898	35,210	4,736	52,061	92,844	35,453	22,564	53,620	71,800	62,002
British South Africa	7,309	7,340	19,389	41,193	27,671	20,580	28,822	29,917	71,478	143,582	194,322	98,956	484,545	336,182	312,822
Philippine Islands	10,183	8,933	23,387	19,162	5,824	13,498	10,266	13,640	12,568	25,936	78,673	60,568	252,505	251,431	186,656
Peru	.....	2,399	6,926	15,073	40,651	13,010	35,294	31,631	30,151	71,477	77,964	44,783	153,905	222,829	190,613
Finland	.....	.....	8,956	25,644	24,947	11,909	35,934	2,784	64,215	26,058	2,636	.....	110,364	63,106	20,620
Switzerland	7,271	7,338	7,416	18,653	17,108	11,557	22,627	57,403	54,052	117,889	178,264	.....	230,333	257,935	18,889
Dutch East Indies	9,335	4,365	8,341	26,443	6,366	10,970	20,216	9,229	56,281	245,594	168,684	243,678	614,498	326,086	361,296
Straits Settlements	340	1,044	29,074	7,103	14,638	10,440	18,930	3,514	5,186	22,036	10,357	11,616	29,170	53,420	27,815
China	7,117	6,339	13,287	19,923	3,192	9,972	17,668	25,321	54,456	119,245	109,780	87,710	1,360,433	932,351	371,184
Uruguay	.....	11,193	5,515	19,305	13,828	9,968	20,612	1,845	5,382	27,162	29,281	5,770	47,014	53,833	19,898
Portuguese Africa	.....	3,954	5,755	9,437	7,418	5,313	4,523	8,072	4,052	13,007	21,761	6,139	17,662	22,292	74,133
Japanese Leased Ter. (China)	2,863	.....	17,020	5,877	120	5,176	6,909	6,559	453	15,340	4,316	3,845	31,700	10,621	7,452
Venezuela	11,909	761	4,100	2,941	4,706	4,883	4,950	6,975	7,080	17,365	25,581	4,585	22,808	50,875	50,613
Colombia	3,462	1,240	7,795	1,939	8,967	4,681	16,838	11,572	9,488	20,859	17,087	3,548	27,550	112,043	107,909
Turkey in Europe	.....	.....	6,750	9,693	3,105	3,910	1,911	210	.....	.....	.....	.....	941	32,537	10,395
Ecuador	815	2,006	1,054	13,659	510	3,609	5,077	3,567	2,972	16,700	14,307	2,803	7,716	18,736	25,181
Newfoundland and Labrador	9,339	283	2,358	2,810	1,992	3,357	958	519	6,216	5,977	7,824	1,500	8,341	13,746	7,879
German Africa	.....	5,976	2,091	6,930	1,491	3,298	308	860	90	.....	.....	.....	.....	1,353	.....
Ireland	152	1,634	15	7,782	6,512	3,219	4,297	2,489	2,869	2,931	.....	1,293	12,066	136,470	62,197
Portugal	1,892	4,232	3,149	3,070	1,391	2,747	8,903	1,612	14,829	75,987	67,718	11,185	49,343	64,086	14,020
Chosen	4,958	325	5,378	1,179	50	2,378	.....	.....	5,389	6,398	3,166	580	2,306	12,403	4,447
Costa Rica	1,542	3,481	3,921	1,018	1,432	2,279	2,602	48	3,163	5,715	9,875	1,216	4,120	19,057	7,364
Turkey in Africa and Egypt	6,089	1,242	597	3,096	176	2,240	.....	.....	.....	.....	.....	.....	.....	.....	.....
Santo Domingo	830	1,087	559	4,272	3,837	2,117	2,990	4,315	6,280	33,370	52,196	6,580	24,239	49,103	54,932
Other British East Indies	165	.....	357	6,230	3,007	1,952	589	450	250	198	15,356	10	12,754	6,290	1,289
Hongkong	1,905	2,040	1,779	1,061	59	1,369	660	.....	905	2,391	15,565	24,043	57,657	197,338	111,451
Br. W. Indies—Barbados, Jamaica Trinidad, Tobago and Other Br..	197	1,387	4,891	307	23	1,361	2,220	2,218	2,120	12,446	23,312	5,566	29,199	79,259	65,888
Bolivia	61	.....	.....	5,937	187	1,237	9,896	291	56	1,725	15,679	12,390	22,353	14,831	6,133
Turkey in Asia	.....	442	330	375	3,219	873	1,468	4,529	.....	.....	.....	.....	1,252	5,457	2,862
Salvador	738	1,120	2,000	.....	241	820	2,108	36	2,752	7,066	12,530	445	4,673	3,794	5,508

United States—Exports of Metal Working Machinery—*Continued*

Period—1909 to 1921, Inclusive

Country	1909	1910	1911	1912	1913	Annual Average for 5 Years	1914	1915	1916	1917	Fiscal Year 1918	July 1st to Dec. 31st 1918	1919	1920	1921
Russia in Asia	.....	242	1,416	393	1,600	730	1,381	365,389	2,052,170	2,740,874	111,263	8,425	157,840	7,336	.....
British Guiana	89	1,316	1,668	242	206	704	61	163	367	3,191	12,602	10,713	8,820	6,462	331
Roumania	56	1,814	.....	1,431	110	682	3,239	1,200	.....	.....	.....	.....	6,344	104,841	244,374
Guatemala	267	750	224	673	997	582	4,312	294	4,883	4,633	2,595	3,087	12,115	9,923	13,947
British West Africa	.....	792	434	1,666	.....	578	557	2,155	3,894	5,843	1,996	16,904	14,208	8,059	1,434
British Honduras	.....	.....	2,855	.....	.....	571	435	273	19	187	321	1,042	382	107	471
Greece	.....	25	.....	.....	2,310	467	548	779	10,345	7,327	630	720	41,588	55,372	50,554
Nicaragua	895	344	521	.....	80	368	1,104	449	233	1,251	905	607	15,778	6,037	5,543
Siam	215	.....	435	294	870	363	1,449	354	225	6,477	15,047	4,793	6,139	2,500	7,190
Haiti	139	397	939	186	100	352	125	.....	826	5,174	30,017	620	7,239	4,481	1,812
French Oceania	.....	.....	.....	.....	1,645	329	.....	.....	3,061	120	94	65	7,408	4,880	1,201
Honduras	.....	647	.....	310	607	313	110	5,418	2,358	2,360	1,429	364	10,636	30,498	27,441
French Guiana	991	72	.....	.....	.....	213	.....	.....	.....	.....	.....	.....	260	9,955	12,573
German Leased Ter. (China)	833	.....	.....	.....	.....	167	.....	.....	.....	.....	543	.....	.....	.....	.....
Bermuda	282	144	.....	355	.....	156	131	50	289	161	1,091	79	607	2,386	3,092
Dutch Guiana	.....	.....	700	.....	.....	140	.....	.....	.....	916	446	283	675	2,046	19,029
Bulgaria	120	480	.....	.....	13	123	8,173	.....	.....	.....	.....	.....	.....	14,071	1,609
Persia	.....	.....	.....	.....	400	80	.....	13,628	.....	203	3,190	.....	.....	.....	4,425
French Africa	.....	.....	.....	210	175	77	.....	500	.....	.....	314	.....	8,436	9,749	1,591
Other British Oceania	18	118	.....	79	72	57	309	205	21	279	18	.....	212	67	1,869
Canary Islands	.....	.....	.....	144	100	49	.....	.....	.....	10	8,558	.....	91	1,079	328
French Leased Ter. (China)	.....	235	.....	.....	.....	47	.....	.....	.....	.....	77	.....	.....	.....	.....
German Oceania	.....	.....	.....	4	106	22	.....	.....	.....	.....	.....	.....	140	1,283	940
Danish West Indies	36	.....	.....	.....	7	9	.....	12	39	1,079	5	.....	788	5,010	3,903
French West Indies	.....	.....	.....	.....	11	2	.....	250	8	9,787	5,254	2,138	7,777	3,468	4,879
Dutch West Indies	.....	.....	.....	.....	9	2	31	15	5,034	3,402	13,743	209	1,264	1,297	15,147
Azores and Madeira Island	.....	.....	.....	.....	.....	.....	416	272	104	.....	.....	.....	290	8,681	4,872
Gibraltar	.....	.....	.....	.....	.....	.....	10	200	1,015	2,268	.....	.....	4,044	.....	.....
Iceland and Faroe Islands	.....	.....	.....	.....	.....	.....	.....	.....	.....	328	218	80	616	1,702	950
Malta, Gozo, etc	.....	.....	.....	.....	.....	.....	965	.....	.....	.....	.....	.....	.....	135	.....
Paraguay	.....	.....	.....	.....	.....	.....	237	.....	.....	.....	14,036	.....	5,484	10,115	.....
Aden	.....	.....	.....	.....	.....	.....	.....	125	.....	.....	.....	.....	805	.....	.....
Belgian Kongo	.....	.....	.....	.....	.....	.....	.....	.....	.....	1,302	53	75	18,267	7,222	1,603
British East Africa	.....	.....	.....	.....	.....	.....	300	.....	346	2,839	8,621	3,603	159	6,925	7,060
Egypt	.....	.....	.....	.....	.....	.....	2,839	69	178	11,153	3,132	2,055	11,685	31,412	14,419
Liberia	.....	.....	.....	.....	.....	.....	.....	.....	10	615	.....	.....	.....	.....	.....
Madagascar	.....	.....	.....	.....	.....	.....	.....	.....	60	1,425	1,588	.....	975	2,050	17
Morocco	.....	.....	.....	.....	.....	.....	.....	.....	355	5,528	.....	.....	737	5,337	1,066
Spanish Africa	.....	.....	.....	.....	.....	.....	.....	.....	.....	67	.....	10,860	.....	.....	.....
French East Indies	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	25	.....	5,785	.....	476
Miquelon, Langley	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	25	1,105	19
Poland and Dantzig	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	38,676	108,281
French Indo-China	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	2,982	.....
Czecho-Slovakia	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	2,859	.....
Hungary	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	2,324	.....
Yugo-Slavia, Albania, etc	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	124
Hedjaz and Arabia	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	128
Palestine and Syria	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	401
Annual Totals	$3,640,034	$5,975,503	$9,626,965	$12,151,819	$16,097,315	$9,498,327	$14,011,359	$28,162,968	$61,315,032	$84,935,410	$58,327,668	$25,213,050	$58,507,942	$44,312,233	$19,635,821

Note.—Period from 1909 to 1918 inclusive consists of Fiscal Years ending June 30th, and period from 1919 to 1921 inclusive consists of Calendar years.

Ideas from Practical Men

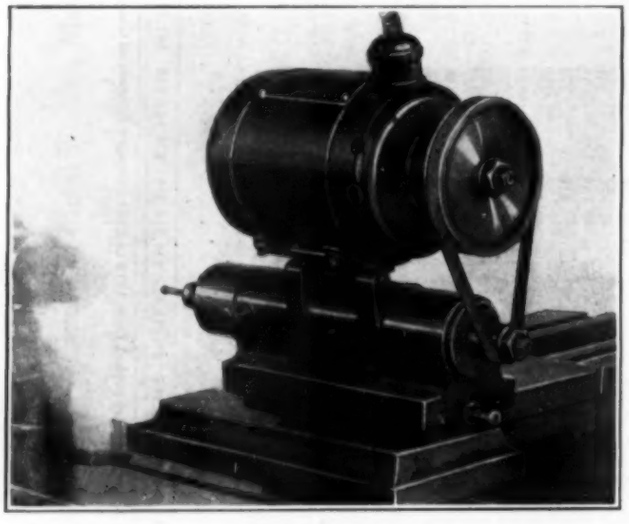
Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.

Experiment With High Speed Grinding Head

By Ellsworth Sheldon

Almost the final operation performed upon the Jacobs drill chuck is to grind the jaws to insure concentricity of running. As some of the chucks are quite small, the grinding wheels are correspondingly minute and must run at exceedingly high speeds. Some of the little wheels are but ⅛ in. outside diameter and run at a speed of 50,000 revolutions per minute.

The work of grinding has been done on a grinding machine of standard make with the regular internal



EXPERIMENT WITH HIGH SPEED GRINDING HEAD

grinding head and, owing to the necessity for frequent renewals, the Jacobs Co. has been making the spindles in its own shop.

The work of making them is very simple but as a spindle could not be made to run at this excessive speed for more than 8 or 9 hours without developing a looseness in the bearings that would put it out of service, the making of a new spindle every day for each machine not only imposed a monotonous burden upon the tool room force but greatly increased the overhead charges on the work.

To relieve this burden the company has been experimenting with a "Dumore" high speed grinding attachment and the cut shows the device mounted upon the machine, doing away with the back counter and belt drive. At the time the photograph was taken the Dumore had been running more than 400 hours (not consecutive) and had not developed any perceptible looseness in the bearings. The motor is running 15,000, and the grinding spindle 50,000 revolutions per minute, upon Norma ball bearings.

Putting Limits on All Dimensions—Discussion

By Martin H. Ball

The article under the above title by John Thomas, which was published on page 639, Vol. 56, of *American Machinist*, and the discussions which followed have interested the writer very much. While there are times and places where it is best to vary almost any rule, it seems to me that Mr. Thomas is nearly right in asking for limits on all dimensions. I mean by all dimensions, those which apply to finished surfaces and not the dimensions that concern the pattern maker only. Exceptions are made in instances where the requirements for some surface without machine finish are unusually exacting.

This method does not involve as much extra work on the part of the designer and draftsman as it would seem at first thought. There are many cases where notes stating the limits on a drawing can be used, as for example, "The limits on all dimensions on this drawing are $\begin{matrix}-0.002\\+0.002\end{matrix}$ in." The limits may be grouped as follows: "All holes on this drawing have a limit of $\begin{matrix}-0.001\\+0.001\end{matrix}$ in., all diameters $\begin{matrix}-0.0005\\+0.0005\end{matrix}$ in. and all other dimensions $\begin{matrix}-0.003\\+0.002\end{matrix}$ in." Where there are some dimensions that cannot be easily grouped, these can each be limited in the usual way and the others can be taken care of by a note thus, "Where not otherwise shown, all dimensions have a limit of $\begin{matrix}-0.0005\\+0.0015\end{matrix}$ inches."

Placing limits on dimensions, however, does require a more thorough knowledge of the requirements on the part of the designer. Because of this fact and on account of the extra time required in designing and drafting, many who are responsible for results hesitate to insist that dimension limits be specified. But they fail to realize the time lost in the machine shop due to uncertainty and they overlook the fact that a much better product might be obtained if all concerned knew exactly what was desired.

When parts go to different departments to be machined, this uncertainty increases. The man who makes the holes may know how much allowance should be made for the shaft or pin to fit properly, but he does not know how much allowance the man who made the shaft or pin did allow. The designation desired is that which is plainest to the dullest and the least experienced worker. Any plan can be learned and used, but the plainer it is, the less will be the cost in time and material. I feel, therefore, that the plans suggested by Frank C. Hudson on page 794, Vol. 56, and by J. A. Roy, on page 188, Vol. 57, of *American*

Machinist have much merit. The only change that I would suggest is that the desired size may be always shown in large figures first and followed by the allowable tolerances, which may or may not be an equal amount above and below the desired size.

For illustration, a fit of 0.003 in. clearance is desired where a minimum of 0.002 in. and a maximum of 0.006 in. are permissible. The dimension for the hole would be 1.793 $^{-0.0005}_{+0.0015}$ in. and the dimension for the shaft would be 1.790 $^{-0.0015}_{+0.0005}$ in. The basic dimensions of 1.793 in. and 1.790 in. stand out prominently, will be read first and are likely to be understood as the sizes desired for a first-class job without further explanation from any one.

An Uncommon "Shark's Jaw"

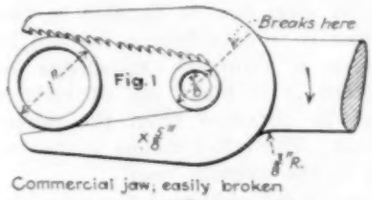
By J. T. Towlson

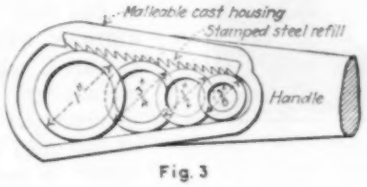
London, England

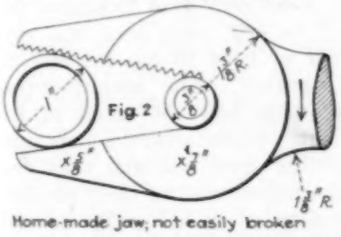
The common "shark's jaw," usually known in America as the alligator wrench, than which few tools are of greater all-round service, is shown in Fig. 1 of the accompanying sketches in its commercial form. Its life is long, if properly used, but, as with the Clyburn shifting spanner, the rule governing its proper use is more honored in the breach than in the observance. When it is abused it soon breaks along the line indicated in the sketch. Home made shark's jaws like that shown in Fig. 2 have greater strength here and, though a trifle heavier, they last much longer.

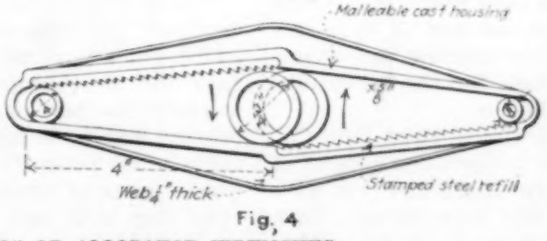
The tool shown in Fig. 3 is still stronger for the reason that the jaws are tied together at the outer end, leaving a triangular opening into one side of which the tool steel toothed section is inserted. The body of this tool, as also the one shown in Fig. 4, is of malleable iron. The common form, Fig. 1, is somewhat paradoxical in design in that the larger the work upon which it is used the greater is the leverage tending to break it across the throat. It is to counteract this defect that the tool shown in Fig. 4 has the triangle reversed. This latter tool is made double ended and will handle from $\frac{1}{8}$ to $\frac{3}{4}$ in. gas pipe sizes.

[The fact that the wrenches in Figs. 3 and 4 can be used only by passing them over the ends of pipe or rods limits their usefulness.—Editor.]









"SHARK'S JAW," OR ALLIGATOR WRENCHES

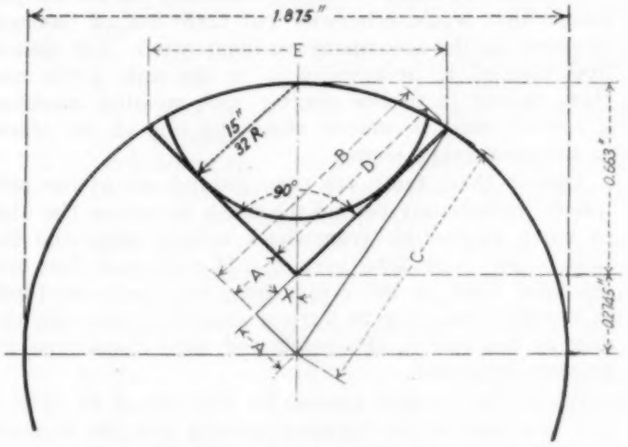
FIG. 1—THE COMMON KIND. FIG. 2—A STRONGER "HOME-MADE" TOOL. FIG. 3—SINGLE-END WRENCH; CLOSED. FIG. 4—DOUBLE-END TOOLS WITH TRIANGLE REVERSED

A Problem in Shop Trigonometry

By Edward J. Rantsch

Every now and then some mathematical problem confronts us in our regular line of work that makes us employ a little trigonometry to reach a solution. In this case it was required to make a piece with a groove of 90 deg. included angle. This groove was to receive another part having a circular form with a $\frac{15}{32}$-in. radius on one side and a radius on the other side to conform with the radius of the first piece, which was 1.875 in. in diameter. The center about which the $\frac{15}{32}$-in. radius was drawn was to lie on the circumference of the circle of 1.875 diameter, as shown in the accompanying sketch.

The first step was to take the $\frac{15}{32}$-in. radius and multiply it by 2, which gives a 0.9375-in. diameter.



A PROBLEM INVOLVING SHOP TRIGONOMETRY

Letting this diameter 0.9375 in. equal the distance across the flats of a square, and multiplying it by 1.4142 gives us 1.326 in. as the distance across the corners of the square; dividing by 2 we get 0.633 in. as one-half the distance across the corners of the square. As the diameter of the large circle is 1.875 in., the radius is 0.9375 in. Subtracting 0.663 in. from 0.9375 in., we get 0.2745 in. as the distance from the corner of the square to the center of the piece, as noted in the illustration.

Now drawing a small triangle at this point in which 0.2745 in. becomes the hypothenuse and angle x equals 45 deg., then sin x, or 0.707 $\times$ 0.2745 in. equals 0.194 in. for lengths A and A, which are two equal legs.

By drawing line C, which is a radius of 0.9375 in., we get another right-angle triangle in which A equals 0.194 in., and C equals 0.9375 in. Dividing A by C, or 0.194 in. $\div$ 0.9375 in., gives 0.20693 as sin x. Then x is 11 deg. 57 min. Multiplying the cosine of 11 deg. 57 min., which is 0.97833, by C or 0.9375 in., we get length B, or 0.917 inches.

Having found length B to be 0.917 in. and length A 0.194 in., subtract A from B and we have 0.723 in. as the length D, which is equal to one side of the groove.

Now assuming that 0.723 in. is the length of one side of a square, or in other words, the distance across the flats of a square, to get the distance across the corners multiply 0.723 in. by 1.4142, and we have distance 1.0225 in. for *E*. This value represents the length of the chord and is the last unknown dimension to be found. Thus we have found all the unknown dimensions by the use of shop trigonometry, reasoning step by step, a method that can usually be employed in solving the problems that arise in everyday practice.

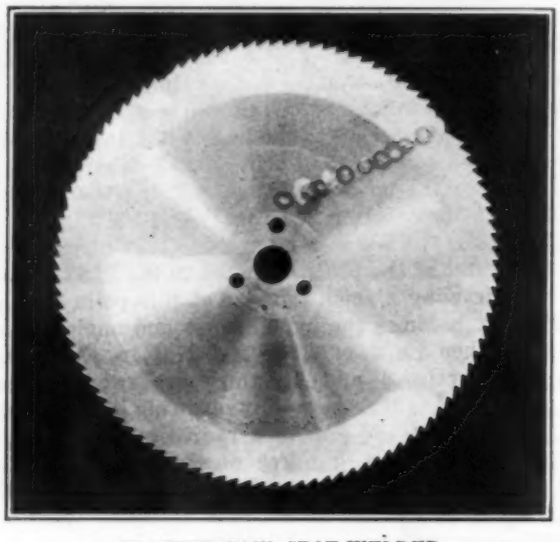
Salvaging Cracked Saws by Welding

By Ellsworth Sheldon

A method of salvaging the circular saws used on certain metal sawing machines when they have developed cracks that would otherwise put them out of business is shown in the accompanying illustration The disk is first cleaned by immersing it in the soda kettle and then, taking it to the electric spot welding machine, a row of spots is welded along the line of the crack, as the photograph shows.

Two or three teeth are then ground out of the periphery immediately behind the crack to relieve the disk as much as possible from shock at this point and the saw is put back into service. If the crack has not extended clear to the center hole, the acetylene torch is brought into play to burn a small hole through the disk at the end of the crack and thus discourage its further extension.

While this method cannot be guaranteed to save a saw, its application requires nothing but the expenditure of a few minutes time in a shop where the electric welding machine is already installed and, if it is successful, will keep in service as a valuable tool a saw that is otherwise but a candidate for the scrap pile. If it fails nothing is lost but the time.



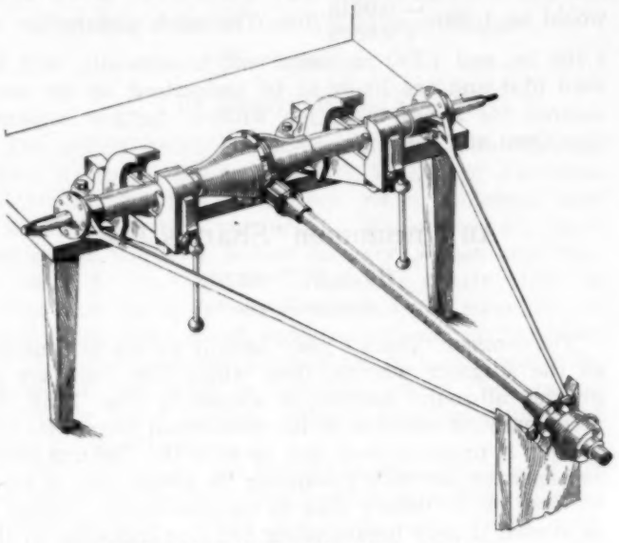
CRACKED SAW, SPOT WELDED

At the Butterfield plant of the Union Twist Drill Co., Derby Line, Vt., the writer saw in operation several of these saws that had thus been reclaimed and that were doing as good service as before they were cracked. Such a repair would not be advisable, however, on the swiftly moving saws used in the wood working shop because the consequences of failure would be too disastrous.

Two Vises to Handle Axle Assemblies

By G. A. Luers

In the absence of a special stand for holding either front axles or rear axle assemblies, which stands are very serviceable for overhaul, the use of two vises placed three feet apart on the edge of a bench, as shown in the sketch, will afford a means of clamping the axles solidly while renewing bushings, putting on spindles, aligning gears or adjusting the many parts. It is possible with an assembly like a Ford rear-end to clamp the housings in the vises, place a block under the drive shaft end and work on the universal, connection, radius rods, put in the retaining bolts, cotters, etc., as well as carry out the work of overhaul from a most favorable and comfortable working position. But a third of the time is required to assemble these parts in this manner, as well as to add to the comfort and convenience of the workman.



TWO VISES FOR HANDLING AXLES

Can These Things Be True?—Discussion

By R. Kraus

In reply to M. Tolliver's article, which appeared under the above title on page 270 of *American Machinist*, it is the writer's opinion that the problem of the heat treatment of steel can be handled in two different ways. One way is to determine a method by research, which requires a thorough knowledge of metallurgy, and the other is to make use of reliable information which can be obtained from the maker of the steel to be treated. The latter means is the one which is best adapted to the average user.

The steel manufacturer is not only glad to supply the necessary information but he will even send his specialist for a demonstration as it is to his interest to have the steel properly treated. The manufacturer is really the best one to judge how the merit of his product may be brought out. Manufacturers now pursue a broad policy in building good will and they frequently go to an expense in demonstrating their product since they anticipate the demand in a locality as well as in a special prospect.

Good information may also be found in the catalogs of allied products, as for instance in a catalog of a

company which manufactures pyrometers. All the knowledge necessary is the analysis of the steel one is using.

This condition is a reminder of what is expected from us in the successful treatment of steel and that is just a little effort to keep rigid order in the stockroom. If we are using the makers' information, we do not have to know the composition of the steel, but we must know with certainty what steel we have. This condition requires a rigid rule to mark the incoming steel immediately, by stenciling it with vivid color every few feet and at both ends. As a chart must be followed, the blueprint of it should be framed and given a coat of transparent shellac.

The suggestions made are not new, but they form one of the principles of production, namely, to avail oneself of the cumulative experience of others, which is a secret of saving time.

Two Ways of Making a Core—Discussion

By M. E. Duggan

On page 461, Vol. 57, of the *American Machinist*, P. W. Blake offers criticism of an article by the writer under the above title on page 233, Vol. 57. In presenting that article I had in mind the apprentice and the young journeyman pattern maker who have been denied the privilege of visiting in the foundry and core room, and who welcome any information they can get through the columns of trade papers. Moreover, I had in mind general pattern, molding, and core making practice and not any one specialty. I merely used the sketch as an example of the method used by the core maker in making cores with projecting members, *dried on end*.

Again I ask, "Is this method practicable and does it answer the requirements of the core maker?" We are told that the pattern maker predetermines the operations of the molder and the core maker. I don't believe this. The apprentice or journeyman pattern maker who has had little or no training in practical molding and core making is mighty poorly equipped to even hint at how the job should be done in either of these departments of the foundry. Mr. Blake says, "Any pattern maker trained in the manufacture of plumber's brass goods knows that the practical method is to use core driers on small sizes, because the driers keep the cores from warping." Why should a special training in plumber's brass goods be necessary to know and understand the "why" and the "wherefore" details that pertain, not to any individual specialty, but to general pattern making practice.

Mr. Blake mentions the word "proper" in connection with the making of these cores and driers. The word "proper" does not apply in the making of patterns, core boxes, molding, or core making. The superintendent of a large foundry doing a general jobbing business has remarked, "Make a pattern and the core boxes for it, send them to the foundry and the molders and core makers will tell you of nineteen better ways by which they can be made."

In conclusion, I think it only fair to suggest that when reading an article illustrating and describing a way to do a certain piece of work with a view to criticizing it, you either read it as it is written or *read between the lines*. If the method has any merit in comparison with your way of doing the particular job, then use it; if it has not, then pass it up.

Removing a Bushing from a Blind Hole —Discussion

By W. H. Storey
Surrey, England

In an article under the above title on page 865, Vol. 56, of the *American Machinist*, Art Weiss, in criticizing the method of removing a bushing from a blind hole as outlined by me, asks why we should not make the bushing as shown in his sketch. I think it is up to me to answer his question. I do not think it can be denied that the following points are against his method:

1. A plain standard bushing from stock cannot be used.
2. Expensive cast steel is used for the tapped portion necessitating slower machining speeds.
3. The tapping of cast steel should always be avoided if possible on account of wear and breakage of taps.
4. Due to the recess, the effective length of the bore is reduced and usually it is desirable to keep the length of the bore of blind hole bushings as long as possible.
5. The bushing may crack in hardening, (a) due to the thread, (b) due to the recess, (c) due to the excess of metal at the bottom.
6. Grinding the blind hole in the bushing is objectionable, demanding as it would a great amount of time. Blind holes are the cause of much grinding-wheel breakage and are never as satisfactory as the straight-through bore.
7. In order to grind the outside diameter a special mandrel will have to be made as a standard mandrel cannot be used.

Mr. Weiss states that my method involves the hunting up of loose washers when the bushing has to be removed. May I point out that this is not accurate, for, as with his method, a setscrew is all that is required to extract the bushing. In fact our methods are virtually the same with the exception that I require a shorter setscrew and have the tapped portion made separately from a piece of soft machine steel, thus enabling a

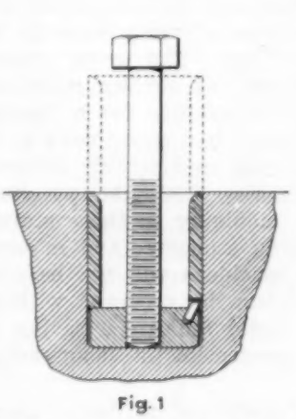


Fig. 1

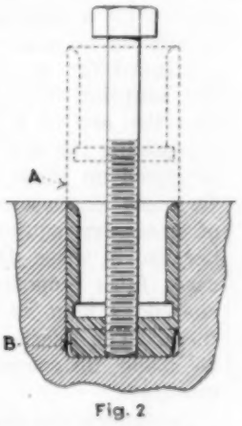


Fig. 2

FIG. 1—THE AUTHOR'S METHOD. FIG. 2—ART WEISS' METHOD

standard bushing to be used. By my method the necessity of a recess with its attendant risk of cracking and wheel breakage is eliminated, less of the expensive cast steel is used, much less time in manufacture is required and there is no necessity for making a special mandrel for grinding the outside diameter.

If, after reading this, Mr. Weiss ever again uses the

method he outlined, I would suggest that at least he chamfer the bottom of the bushing or turn it away, as shown at *B* in Fig. 2, so the blind hole in the jig casting need not be accurately bored down to a sharp corner at the bottom, and so that a lead will be provided to assist in forcing the bushing in, and prevent it cutting away and enlarging the sides of the hole. Also, by cutting the bushing away, a shorter setscrew can be used for extracting it.

Mr. Weiss states that my method requires some preparation, apparently assuming that his does not, because it is in one piece. As his method requires a special bushing I would suggest that it actually requires more preparation than mine. Comparison can better be made, however, by considering the relative costs. For the convenience of readers the sketches are reproduced, Fig. 1 shows the method adopted by the writer whilst the dotted portion at *A*, Fig. 2, shows the method of Art Weiss. The reduced portion at *B*, Fig. 1, shows the writer's suggested improvement.

Misapplied Machine Tools

BY D. A. NEVIN

The writer has observed, during the past year or two, numerous accounts of single-purpose machine tools being adapted for some special use for which they were never intended. A lathe used for milling, a planer converted into a grinder, a punch press adapted for slotting, are a few of the stunts we read of and there are, of course, many more which have never been published. There are many occasions where it is necessary to rush out some work and, no other machine being available, the foreman is justified in adapting or altering some machine intended for an entirely different purpose. Again in job shops, these stunts are very often necessary due to lack of equipment or the necessity of utilizing as much of the equipment as possible and not have machine tools stand idle.

No lathe was ever designed to absorb the vibrations caused by a milling operation and certainly could not retain its accuracy if this class of work were to be continued for any length of time. The writer recalls the adaption of a small planer for surface grinding, also the use of a hand screw machine for a "push" assembling job and in both cases the regular work to be produced on these machines was considerably delayed. In some cases clever mechanics delay the purchase of necessary equipment by indulging in these stunts, because in these days of strict economy (and in some cases false economy), new machines will not be purchased as long as the work can be produced without them. The overhead cost should indicate a saving to be made in conservative investment in labor-saving machines.

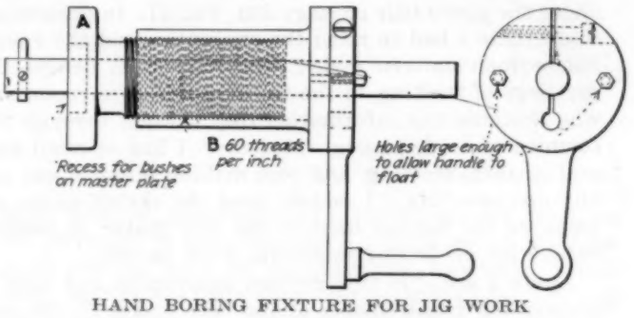
Designers are frequently instructed to design along the lines suitable for manufacture by present equipment and this procedure often proves to be an expensive one when production falls below sales requirements. Automatic screw-machine work is considered very economical because one operator can operate from three to five machines, and yet sometimes, with a little thought, screw-machine parts could be designed for more economical production in the punching machine and generally with an added advantage of saving in the amount of material used.

Bushings Used as Buttons for Locating Holes Accurately—Discussion

BY A. COX

I have read with interest the article under the above title by Harrie M. Pike on page 384, Vol. 57, of the *American Machinist* and, while commending Mr. Pike's method of locating holes on large jigs with bushings, I must take exception to his statement that "The job was then placed on the table of a true running drill press and the holes drilled and reamed through the bushings." In an earlier part of his letter Mr. Pike states that "their location was so important in fact that no tolerance at all was allowed in locating them."

Having spent over thirty years at the tool making game, including three years on large jigs and fixtures for the Sunbeam aeroplane engine for the British Government and in one of the finest equipped toolrooms I have come across in my long experience, I will state that I have yet to find a "true running drill press" that will drill and ream a hole to limits of 0.0002 in. (in location) with slip bushings or anything else. To my view Mr. Pike's method has no advantage over the ordinary button method and certainly is not so accurate as boring with an eccentric chuck.



HAND BORING FIXTURE FOR JIG WORK

I think I am free to admit that the most accurate tool on the market today is the Pratt & Whitney jig boring machine, yet I doubt if the makers will guarantee a drilled and reamed hole to be accurate for location within 0.0002 inch. For the benefit of those engaged on large jig work, I will describe the methods used in the above mentioned shop where the limit of error on production never exceeded $\frac{+\ 0.0002}{-\ 0.0001}$ in. The base of the jig and all machined surfaces are accurately scrapped to a surface plate and all holes laid off and drilled, leaving roughly about 0.020 in. for boring.

We found that in moving a heavy jig around the shop and placing it on a machine it required very little jar to move the buttons and it was necessary to check them all over again. In order to avoid this trouble we abandoned boring the jigs on machines and used the hand-boring fixture shown in the accompanying sketch and which, although slower than the machine, was certainly much more reliable. The boring fixture was made of machine steel, pack-hardened, ground and lapped. The body *A* was accurately located over the hole to be faced and fastened in position by straps. The feed nut *B* was then slipped on, the boring bar clamped to the handle and the boring was performed by turning the handle.

Three boring bars were used, the tools being set for gradual decreasing cuts, the last one removing 0.002 in. and being run through twice. The fixture was then

removed, a ground and lapped plug inserted in the hole and the fixture re-located for the next hole with Johansson blocks or micrometers. The result was a splendid job, without moving the jig from the surface plate. In some instances, a master plate was fastened to the jig and with the hand-boring fixtures located on the plate. With bushes ground to fit both the master holes therein and the recess in body *A* of the boring fixture, it was easy to transfer the same locating points in all jigs used for the one particular part to be machined.

Formula for Determining the Safe Load for Gears

BY V. CHARUSHIN

The accompanying table is based on a gear formula that is commonly used in Germany, and is given by C. Bach in his "Maschinen Elemente," 1920 edition. In comparison with the well-known Lewis formula, this formula gives more conservative values for the safe loads. Consequently, the gears determined according to this table, possess much better wearing qualities.

The basic formula as given by Mr. Bach is as follows:

$$W = Cfp' = C\pi\frac{f}{p} \qquad (1)$$

W = safe load on pitch line in pounds
f = face of gear in inches
p' = circular pitch in inches
p = diametral pitch.

C is a function of r.p.m. and is expressed by the equation:

$$C = 426.69 - 7.11\sqrt{N} \qquad (2)$$

N = r.p.m.

This formula is for machined cast-iron gears and takes an allowable stress equal to 6,400 lb. per square inch when the speed is very low. Equation (1) may be written for diametral pitch as follows:

$$W = \pi(426.69 - 7.11\sqrt{N})\frac{f}{p} \qquad (3)$$

The table is easily computed from equation (3). For steel gears all the values in the table must be multiplied by 2½. The table is especially valuable for preliminary layouts. It gives the safe loads at a glance without the necessity of going through the tedious calculations.

What Is the Best Way to Show Sections Through Ribs?—Discussion

BY ELAM WHITNEY

Under the above title on page 458, Vol. 57, of the *American Machinist*, Martin H. Ball's illustration, as the writer sees it, does not keep the draftsman's work down to a minimum as would be the case if the section *X-X* were taken through the holes.

This is especially true of drawings where the holes are numerous and the method of taking a cross-section "off center" is one which will be found of value in a great variety of drawings, as for instance assembly of punches and dies, when it is desired to show up projections corresponding to the rib that was shown in the illustration given by Mr. Ball.

If the drawing were made in accordance with the above method, not only would the area to be cross-sectioned be reduced, but the lines would show up much clearer as well and especially would this be the case if a blueprint were made from it.

SAFE LOAD IN POUNDS FOR MACHINED CAST-IRON GEARS

NUMBER OF REVOLUTIONS PER MINUTE																				
50	59	71	83	106	142	177	236	355	591	828	1,183	1,774	2,365	3,548	4,730	5,912	8,278	11,826	17,738
75	57	69	80	103	138	172	229	344	573	803	1,147	1,720	2,294	3,441	4,588	5,735	8,029	11,471	17,205
100	56	67	78	100	134	168	223	335	559	782	1,117	1,676	2,234	3,351	4,468	5,586	7,820	11,171	16,757
125	55	65	76	98	131	164	218	327	545	763	1,091	1,636	2,181	3,272	4,363	5,454	7,635	10,908	16,361
150	53	64	75	96	128	160	213	320	533	747	1,067	1,600	2,134	3,201	4,268	5,335	7,466	10,669	16,004
175	52	63	73	94	125	157	209	313	522	731	1,045	1,567	2,090	3,135	4,180	5,225	7,315	10,450	15,675
200	51	61	72	92	123	154	205	307	512	717	1,025	1,537	2,049	3,074	4,098	5,123	7,172	10,246	15,369
250	49	59	69	89	118	148	197	296	494	691	987	1,481	1,975	2,962	3,949	4,937	6,911	9,873	14,810
300	48	57	67	85	114	143	191	286	477	667	954	1,430	1,907	2,861	3,814	4,768	6,675	9,536	14,304
350	46	55	65	83	111	138	184	277	461	646	923	1,384	1,845	2,768	3,690	4,613	6,458	9,226	13,839
400	45	54	62	80	107	134	179	268	447	626	894	1,341	1,787	2,681	3,575	4,469	6,256	8,937	13,406
450	43	52	61	78	104	130	173	260	433	607	867	1,300	1,733	2,600	3,467	4,333	6,067	8,667	13,000
500	42	50	59	76	101	126	168	252	420	589	841	1,262	1,682	2,523	3,364	4,205	5,887	8,410	12,616
600	40	48	55	71	95	119	159	238	397	555	793	1,190	1,587	2,380	3,173	3,967	5,553	7,933	11,900
700	37	45	52	67	90	112	150	225	375	525	749	1,124	1,499	2,249	2,998	3,748	5,247	7,495	11,243
800	35	42	50	64	85	106	142	213	354	496	708	1,063	1,417	2,126	2,835	3,544	4,961	7,087	10,631
900	34	40	47	60	80	101	134	201	335	469	670	1,006	1,341	2,011	2,681	3,352	4,693	6,704	10,056
1,000	32	38	44	57	76	95	127	190	317	444	634	951	1,268	1,903	2,537	3,171	4,439	6,342	9,512
f/*p*	0.05	0.06	0.07	0.09	0.12	0.15	0.20	0.30	0.50	0.70	1.0	1.5	2.0	3.0	4.0	5.0	7.0	10.0	15.0

f = FACE, *p* = DIAMETRAL PITCH

Editorial

THERE ARE still some mechanics, and for that matter some foremen and even superintendents, green enough to be proud when they make blue chips with red tools. The proper color scheme is white. If two men take the same size cut at the same speed and one gets his chips blue and the other white, it is a safe bet that the latter has the tool which will last longer and use less power.

Statistics on Foreign Trade in Metal Working Machinery Begin in this Issue

HOW MUCH do we know of foreign trade in machinery? Much has been written—and read—about how to ship machinery across seas. The requirements for dismantling, slushing and boxing have been specified. There has been a word or two about the kind of salesmen to send abroad. Correspondence and mail matters have been touched upon.

But what of the markets? How have exports and imports grown or diminished during the past 10 years? What future is indicated? Statistics on those conditions should be in every sales manager's office. They are available, thanks to the Industrial Machinery Division of the Bureau of Foreign and Domestic Commerce, and they have been handed out piecemeal from time to time. Fortunate the man who could collect them and keep them together.

It is now the purpose of the *American Machinist* to distribute the statistics of foreign trade in machine tools for the years 1909-1921 inclusive. They will be presented each week with either a page or two pages per issue. The tables will show the values of metal working machines exported from the principal countries, the names of the countries receiving them, and the values of the machines received by each. A like arrangement will show the details of imports. Invaluable figures they have been termed by some.

No table will back up another, an arrangement that gives perfect freedom in clipping. Table I, Export of Metal Working Machines from the United States, is in this issue.

What's Wrong With the Railroad Shops?

A VERY ENLIGHTENING series of articles might be written telling the history of railroad development with particular reference to the repair shop angle. The series would tell of the strangling effect of railroad regulation as practiced by federal and state bureaus and would point out the valiant struggles made by the men in charge of the mechanical departments against conditions brought about by insufficient appropriations resulting from lack of revenue. It would also tell of the boring-from-within tactics of labor unions whose rules operated to combat every attempt at progressive management. Such a series would be pleasant to write but it would be outside of our province and would lead to no improvement.

We have the utmost sympathy for the railroad managements in so far as they are oppressed by governmental regulations, and they certainly have had more than their fair share of it, but railroad regulation is here to stay and there is nothing to do but make the best of it. If anything we could say would have any effect in lessening the oppression, we should be only too glad to shout it in 24-point type but we are not so egotistical as to harbor any such idea.

In the series we have written, and of which the second article appears next week, we have discussed things as we found them and tried to point out definite improvements which might be made. If what has been written has seemed to savor of destructive criticism, bear in mind that only a quack doctor endeavors to cure the patient before he finds out what is the matter with him. If we had nothing better to offer, the series never would have been started, for constructiveness has been the aim of the *American Machinist* since its beginning nearly fifty years ago. So far, we have contented ourselves with pointing out the faults. In later articles we shall suggest remedies, drawn from the practice and experience of other shops and applicable to railroad repair shops.

The Red Cross Roll Call

IT SEEMS ESPECIALLY appropriate that the coming Annual Roll Call of the American Red Cross should begin this year on Armistice Day. To many, the splendid service which this organization gave to humanity during the World War ended with the coming of peace in 1918. It would be unfortunate, indeed, if the energy and relief which the American Red Cross still dispenses should be unrecognized or unsupported at this time.

The Red Cross campaign to spread the benefits of hygiene, the active interest in the comfort and entertainment of our disabled Service men, and the ever-ready emergency relief—these alone would justify the annual contribution of a single dollar from each of us. Leading even these good interests, however, comes the active fight which the Red Cross now wages on tuberculosis. Support of the organization in this, the greatest of its campaigns of relief, makes membership almost an obligation for those who can give.

Just Suppose

SUPPOSE you had bought a machine which is guaranteed to turn out twenty-four pieces per hour, let us say, for $6,000. And suppose the best you can possibly get out of this machine is twenty pieces, and even the maker's expert can do no better. You would probably feel that you are entitled to a discount.

Now suppose it were the other way; that you get twenty-eight pieces instead of twenty-four, and that without straining the machine or the man or even your imagination. Would you feel that the maker is entitled to a bonus, and feeling that way, would you offer it?

Oh, come now! You know things are not done that way. Yes, but—

Just suppose.

Shop Equipment News

Baird Six-Spindle Chucking Machine

What is virtually an automatic lathe for handling five short pieces of work at one time has recently been placed on the market by the Baird Machine Co., Bridgeport, Conn. The machine, as shown in Fig. 1, is a six-spindle horizontal chucking machine and is suitable for work on small castings, forgings and bar stock requiring a number of operations such as turning, facing, drilling and threading that can be performed on a lathe. The capacity is for work up to 6 x 6 inches. The chief feature of the machine is the fact that there are always five pieces of work in operation at the same time. As many as twenty-one cutting tools can be used simultaneously. The sixth spindle is in the loading position while the others are operating, so that the work may be inserted and removed without interfering with the operation of the other spindles.

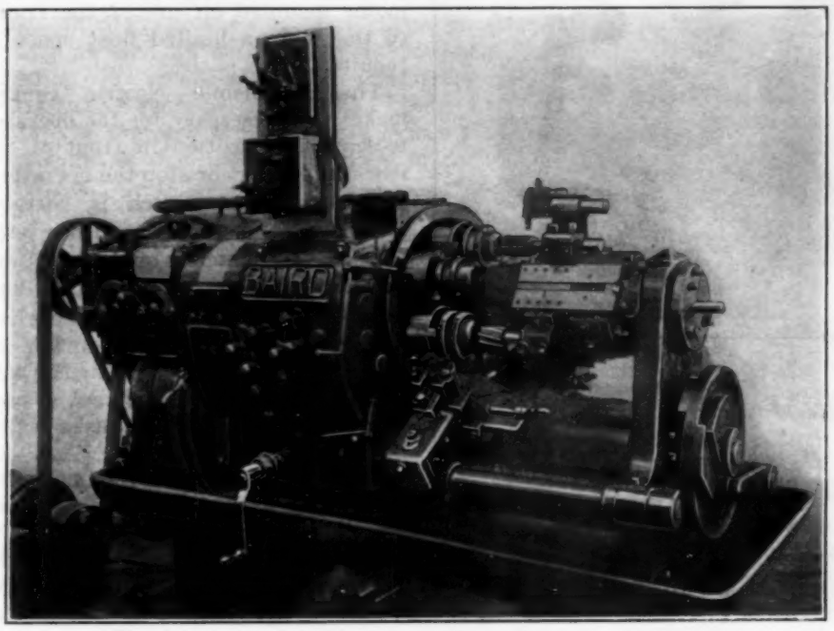


FIG. 1—BAIRD SIX-SPINDLE CHUCKING MACHINE

As the finished piece reaches the unloading position the machine automatically stops, so that a second cycle of operations will not be made on a part due to inattention of the operator. The operator immediately starts the machine again when he is ready to take out the piece, so that the five work spindles need not be stopped during the time required to remove the piece and place a new one in position. The machine can be run without stopping at the completion of each piece.

Separate toolslides are supplied for each working position with a choice of two lengths of feed with any setting. The cross-feed toolslides are mounted on the bed. The toolholders are interchangeable and are designed to receive standard forged or inset tools. The machine can be turned over by hand from either the front or back of the machine for setting the tools.

The machine is ordinarily driven by a single constant-speed pulley at a speed of 800 r.p.m., and it can be arranged for either belt or motor drive, a 5-hp. motor being ordinarily required. The spindle speed varies from 28½ to 440 r.p.m., a total of twenty-four speeds lying between these limits. There are eight possible combinations of gear drives and three quick changes of speed available for each spindle. By changing the gears in the main drive the range of speed of all of the spindles can be raised or lowered; three changes are still allowed for each spindle independent of the other spindles. There are seventeen changes of feed for the cutting tools.

All the changes of speed and feed are effected by heat-treated quick-change sliding gears. The work can be run at the speed and feed best suited to the operation, so that a hole of small diameter can be bored at a high spindle speed while the outside diameter of the work may be turned at a relatively low spindle speed.

Rapid traverse and reverse motions are provided so as to increase the speed of operation. The minimum productive speed with the drive pulley running at 800 r.p.m. is one piece in 9 min., and the maximum is 2⅔ pieces in 1 min. Chucks are ordinarily employed, but special fixtures for holding the work can be substituted. Each spindle has a means of adjustment to take up wear. Back of each spindle is a driving clutch that releases automatically to allow the turret holding the spindles to index. All operating levers are conveniently located in the front.

In Fig. 2 is shown a view of the rear of the machine, in which the cam drum and such features can be observed. A power-operated pump for cutting lubricant is incorporated. The machine requires a floor space of 93 x 46 in. and weighs about 8,500 pounds.

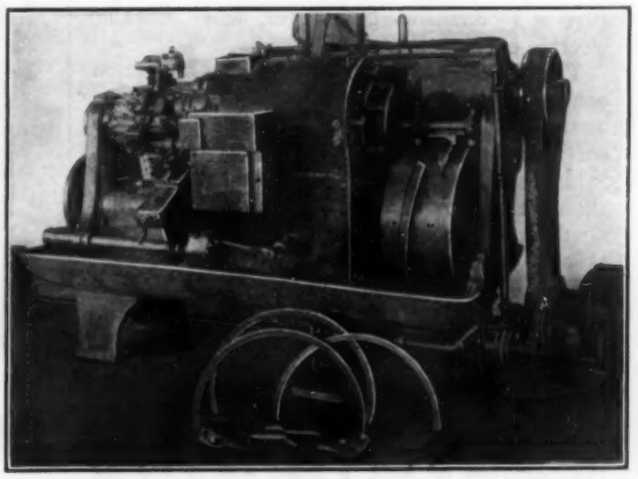


FIG. 2—REAR VIEW OF BAIRD CHUCKING MACHINE

Chambersburg Punching and Shearing Machines

The Chambersburg Engineering Co., Chambersburg, Pa., has recently developed a line of vertical punching and shearing machines on which electrical control is employed. This control mechanism is so constructed that setting and adjustment of the length of stroke can be easily made and the action then performed electrically. The mechanism by which the adjustment is made is mounted on the front of the head and can be seen in Fig. 1, as well as the foot switches by which the operation of the presses can be controlled.

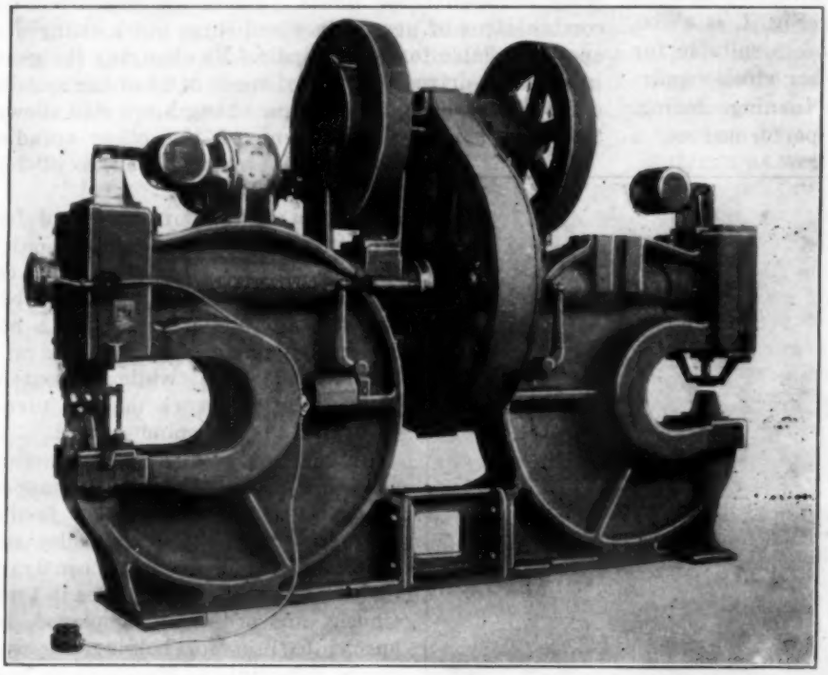


FIG. 1—CHAMBERSBURG DOUBLE-END PUNCHING AND SHEARING MACHINE WITH ELECTRICAL CONTROL

The machine as illustrated is double ended. Two units can be mounted end to end so that the same motive power can be employed for each. Although the electrical control is the chief feature of the new machines, belt-driven machines can be furnished controlled by the mechanism ordinarily employed for this type of work. Such a machine is illustrated in Fig. 2. The electrical control and adjustment feature is recommended, however, when suitable electric current is available.

The frame of the machine is of I-section semi-steel having large fillets as a safeguard against cracking in the corners. Since no cores are necessary in forming the castings, faulty sections can be more readily detected than in a box-section frame. The sliding head is a semi-steel casting and has a broad take-up wedge.

The eccentric shaft is a one-piece steel forging and is employed for the eccentric box. Sight-feed oil cups are provided on the main bearings and the sliding head. The tool blocks are made of cast steel; they can be easily removed by making a quarter turn of a handle. The punch is so constructed as to incorporate the features of both a fixed and a floating punch in one tool.

Machine-molded semi-steel gears are employed, and the pinions are shrouded. Since fractional ratios are used, smooth running conditions are promoted. On the motor-driven machine, a cut steel gear is furnished on the motor shaft. Guards can be supplied for all gears. The driving shaft runs in babbitted bearings.

Eight sizes of the machine are made. On the smallest size a punching capacity of a $\frac{5}{8}$-in. hole through a $\frac{1}{2}$-in. steel plate, or its equivalent, is provided. Plates $1\frac{1}{4}$ in. thick can be split. Throat dimensions of 6, 12, 18 and 24 in. are standard. The largest size machine has a capacity for punching a $2\frac{1}{2}$-in. hole through a 1-in. steel plate, and plates up to $1\frac{5}{8}$ in. thick can be split. Throat depths of 15, 24, 36 and 48 in. are furnished. The entire range of machines is especially suitable for motor drives, with the motor mounted on top of the frame so that only a limited floor space is required.

The automobile electric control makes it unnecessary for the operator to leave his position in front of the machine to start or stop the operation. The push-button switch is portable and may be operated by either hand or foot. The clutch is of the solid jaw, renewable-face type. The sliding half is a steel casting and the fixed half is a part of the large gear and is reinforced by a steel ring shrunk into place. This clutch disengages in case the electric current fails, as a safety measure.

When making the adjustment for the length of stroke, the cap shown on the front of the head is turned to the adjusting position so that the electric circuit is opened and the clutch disengaged. The adjustment is then made by positioning around the cap a headless setscrew which is exposed. The point at which the stroke will end can be easily predetermined. Depression of the pushbutton by hand or foot causes the clutch to engage and the head to descend to the predetermined point. The head then rises and stops.

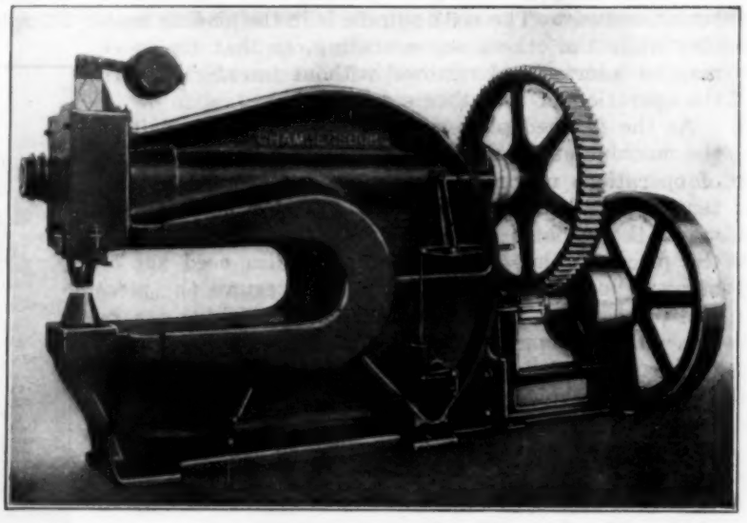


FIG. 2—CHAMBERSBURG MECHANICAL CONTROL PUNCHING MACHINE

Keller Type F Automatic Die-Sinking Machine

The automatic die-sinking machine shown in Fig. 1 is designated as the Type F and has recently been placed on the market by the Keller Mechanical Engraving Co., Brooklyn, N. Y. The machine is intended for work in which impressions up to 36x20 in. and 8 in. deep must be made, and is adapted to the manufacture of forming, stamping and forging dies as well as metal patterns and core boxes.

The machine is intended for smaller and lighter work than the Type BG machine described on page 389, Vol. 55, of *American Machinist*. Since the Type BG machine carries work of very large weight, the work remains stationary and all movements are made in the head carrying the spindle and tracer. The Type F machine is different, because of the moderate size of the work. The horizontal movement is in the work table, which is provided with a range of speeds for cutting as well as a quick-return movement in each direction. The vertical movement and the in-and-out or transverse movement are in the head. Lead screws operate all the movements. There is also a contouring movement, so that a templet, ridge or groove in the pattern can be followed.

The control of all movements is electrical, as regards both the automatic feed and the pushbuttons employed for hand control. The control cabinet contains all of the mechanism necessary for the complete control of the movements. Although the illustration shows the machine equipped with the control board and an angle plate fixture, the control cabinet, which is a separate unit, is not shown.

The machine works from a master, which it reproduces. This master can be of plaster, cement or wood, as only a very slight pressure of the tracer is exerted upon it. However, all the required pressure is applied to the cutting tool, so that large cutting power as well as accuracy in reproducing the patterns can be obtained. The arrangement of the master and the work when cutting a steel die for an automobile front axle is shown in Fig. 2. The work leaves the machine in practically the finished condition, so that only a small amount of handwork is necessary to completely finish it.

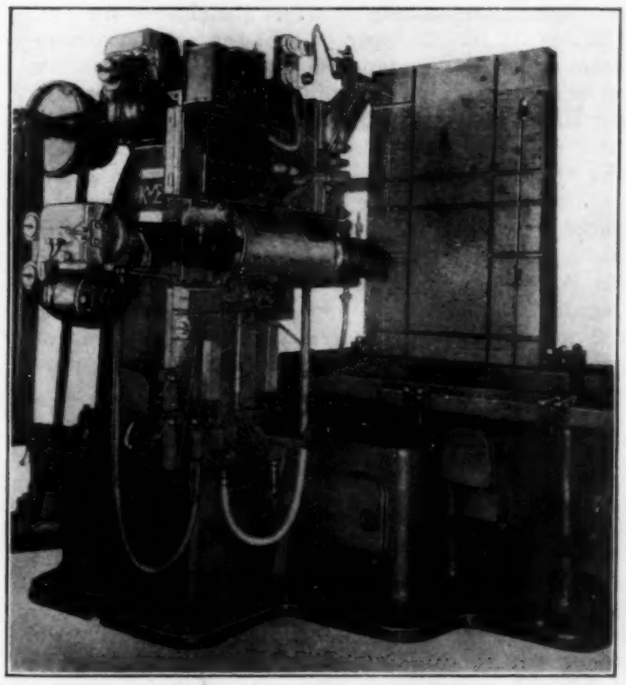


FIG. 1—KELLER TYPE F DIE-SINKING MACHINE

The table has a working surface of 53x22 in. It is provided with T-slots and an oil channel around its edge. Its horizontal travel is 36 in. and speeds from

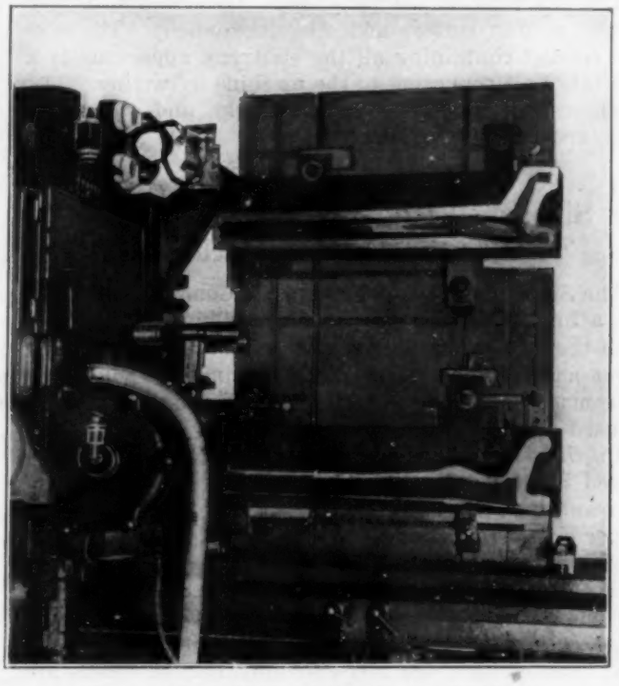


FIG. 2—WORK AND MASTER ON KELLER TYPE F MACHINE

1½ to 12 in. per minute are obtainable through rheostatic control and change gearing. The slide carrying the spindle has a vertical travel of 20 in. on the head; the rate of speed varies from 0.01 to 0.83 in. per stroke. The slide is counterbalanced. The transverse movement of the head is 8 in. This movement is electrically controlled so that the tracer can follow the impression of the master. All the moving slides have large bearing surfaces and are provided with tapered gibs, so that wear can be taken up.

For the purpose of following an outline templet in one plane, there is provided a contouring attachment similar to a profiling attachment. The device is controlled by a pushbutton and follows the outline whether it be inside or outside. The automatic and semi-automatic controls make the machine adaptable to a great variety of operations in which forms must be accurately cut.

Two separate motors are provided, one being a variable-speed motor of ⅝ hp. for controlling the various movements. A 2 hp. d.c. motor for 110 or 220 volts is directly connected to the lower cone-pulley shaft mounted on the rear of the column. The spindle driving pulley is carried on the upper cone-pulley shaft. Two separate spindle driving pulleys, as well as two spindles, one for slow speed and one for high speed, are provided. The slow-speed spindle has the back gears mounted as a unit on the spindle head. The high-speed spindle is driven by means of a grooved pulley from the pulley shaft of the slow-speed spindle. The slow-speed spindle runs in adjustable bronze bearings and is equipped with a No. 9 B.&S. taper; the high-speed spindle has a No. 7 taper. A range of speeds from 80

to 3,636 r.p.m. is obtainable by the two arrangements.

The spindle and slide are lubricated from a multiple sight-feed cup located on the spindle head. Coolant is supplied to the cutter by a force-feed, gear-driven rotary oil pump. The tank for the coolant is provided in the base, so that the coolant drains into it from the trough in the table.

The machine is complete with the motors, tracer points, milling cutters and other equipment. The control cabinet containing all the electrical apparatus is a separate unit connected to the machine by wiring. The machine is about 6 ft. 8 in. in height, and occupies a floor space of 9 ft. x 8 ft. 1 inch.

Sigourney High-Speed Ball-Bearing Sensitive Drilling Machine

The Sigourney Tool Co., Hartford, Conn., has brought out a line of high-speed sensitive drilling machines of both the column and floor types and having single, two, three and four-spindle heads. The single-spindle floor-type machine is shown in Fig. 1; the same style of head is used upon all the machines.

In these machines the spindles are completely enclosed by telescopic sleeves to prevent oil from being thrown upon the work or operator. The projecting upper end of the spindle is also enclosed in a stationary removable sleeve.

The spindles run upon Norma ball bearings and are capable of being driven at a speed of 4,000 r.p.m. without shock or vibration. At a speed of 900 r.p.m. of the first countershaft, the corresponding spindle speeds are 950, 1,600 and 3,000 r.p.m. The spindle driving pulley runs upon ball bearings that are independent of those of the spindle, and it also is enclosed by a hood that is permanently a part of the head bracket. All bearings are standard commercial ball bearings and are conveniently adjustable so as to keep them tight in service.

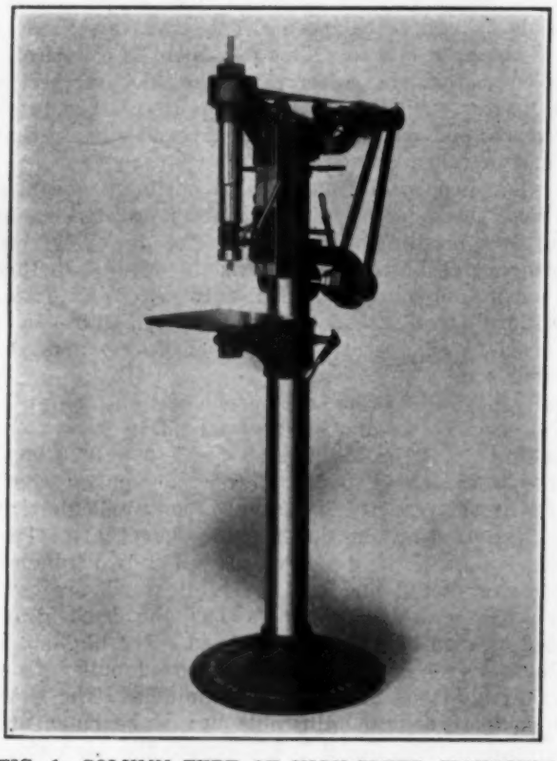


FIG. 1—COLUMN TYPE OF HIGH-SPEED SENSITIVE DRILLING MACHINE

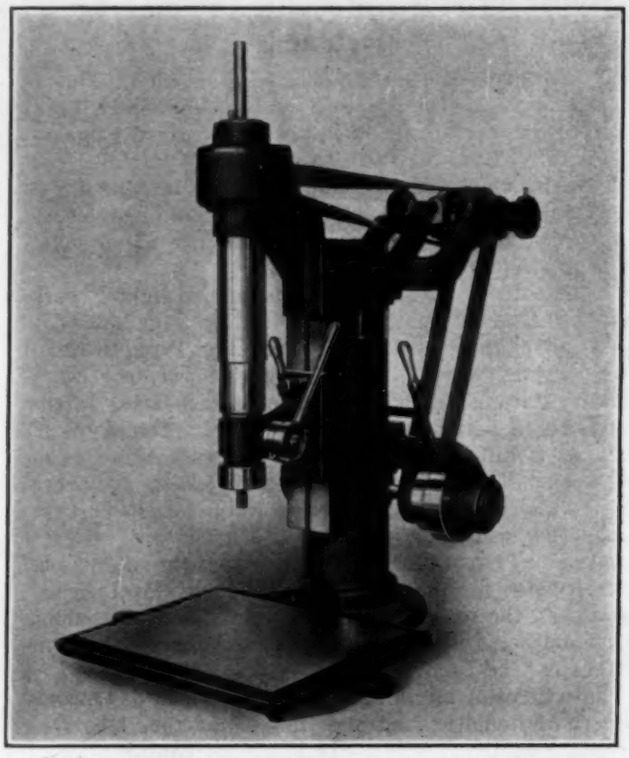


FIG. 2—NO. 1 HIGH SPEED BENCH DRILLING MACHINE

The table may be moved vertically on the column for a distance of 30 in. (33 in. in the single-spindle machine) and is balanced by a counterweight inside the column. A planed line upon the column and a witness mark on the table facilitate setting the hole in the latter in exact alignment with the spindle.

The table dimensions are 9½ by 12½, 12 by 25, 12 by 31 and 12 by 37 in., respectively, for the one, two, three and four-spindle machines. The heads are adjustable vertically upon the face of the brackets for a distance of 6 in. The maximum heights under the chucks are 34½, 32, 32 and 31 in. A taper hole in the spindle accommodates a No. 1 Morse taper shank. The rated capacity when using chucks in the spindles is ⅞ in. drills. If larger sizes are desired, drills with taper shanks should be used directly in the spindles.

The vertical movement of the spindle by rack and pinion is 2⅞ in. and the moving parts are counterbalanced by a concealed coil spring. A clamp stop with a knurled screw for fine adjustments is provided on each head. All belts are endless and the tension of each may be regulated individually by moving the second countershaft, conveniently located screws being provided for this purpose. Chucks, V-blocks, point and bell centers are furnished as extras.

The net weights are 400, 625, 765 and 960 lb., respectively. Boxed for export the machines weigh 600, 860, 1,090 and 1,360 lb., occupying a space of about 37, 45, 58 and 66 cubic feet.

The same type of head is also applied to the No. 1 bench drilling machine shown in Fig. 2, the specifications in the matter of speeds, adjustments and measurements being the same except that the table of the bench machine is 11 by 14 in., the maximum height under the chuck is 8 in., and the weights, net and boxed, are 215 and 360 lb., respectively. The space occupied by this machine when boxed for export is 19½ cubic feet.

Bausch & Lomb Contour Measuring Projector

A contour measuring projector by means of which gages, threaded work, gears and form cutters may be inspected, has been placed on the market by the Bausch & Lomb Optical Co., Rochester, N. Y. With the instrument, all sorts of small parts can be inspected for contour, and after heat-treating can be checked to detect distortion.

The equipment does not require a dark room for operation, as the image is produced on the horizontal table supported on the front leg of the stand. A curtain drapes the table to exclude the light of the room, as shown in Fig. 1. As the screen is attached to the instrument, any inaccuracy from the vibration of the screen alone is eliminated. Leveling screws are placed

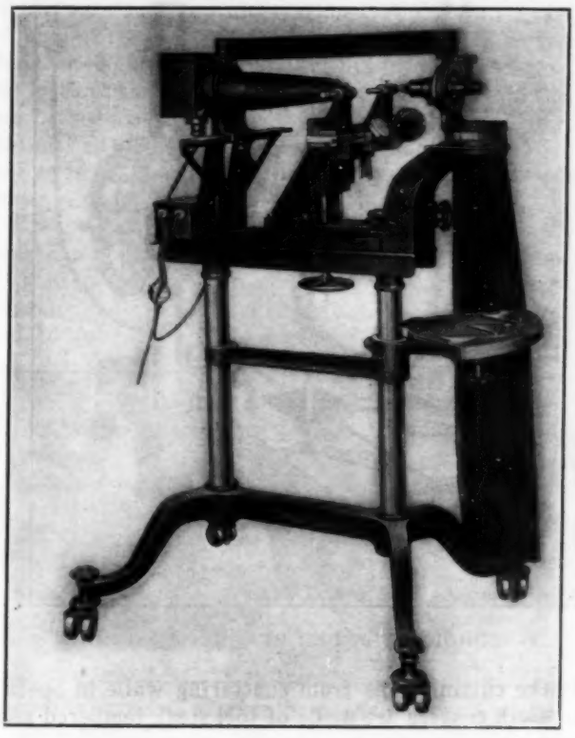


FIG. 1—BAUSCH & LOMB CONTOUR MEASURING PROJECTOR WITH ADJUSTABLE THREAD CHART AND LEAD MEASURING ATTACHMENT

in the base so that, when in use, the base may be lifted off the castors.

The work carrier is a compound slide which may be given three movements by screws with handwheels. One handwheel controls the vertical and one the lateral movement to bring the work into position, while the third produces a movement toward or away from the objective for focusing the image on the screen. As a pair of V-blocks with adjustable centers is part of the equipment, the work may be held between centers or may be supported by the V-blocks. The adjustable thread chart, lead measuring device, screw holder, gear attachment, two opaque attachments, photographic plate holder, and angle plate are devices that can be furnished for attachment to the instrument.

A special concentrated, single-filament, 6-volt, 108-watt, Mazda lamp, operating in conjunction with a transformer on an alternating current is regularly supplied. For extremely critical work, the "Tungsarc" lamp is recommended for use when projecting gear contours at high magnifications, or inspecting spiral gears by reflected light. The light condensers are mounted in a cone which keeps them always in optical alignment. The iris diaphragm allows the diameter of the beam to be reduced as required. If desired, the prism reflecting the light down on the table and forming an enlarged image, can be swung out of the way on an arm, so that the light is projected straight ahead on a vertical screen. The optical system is fixed, and

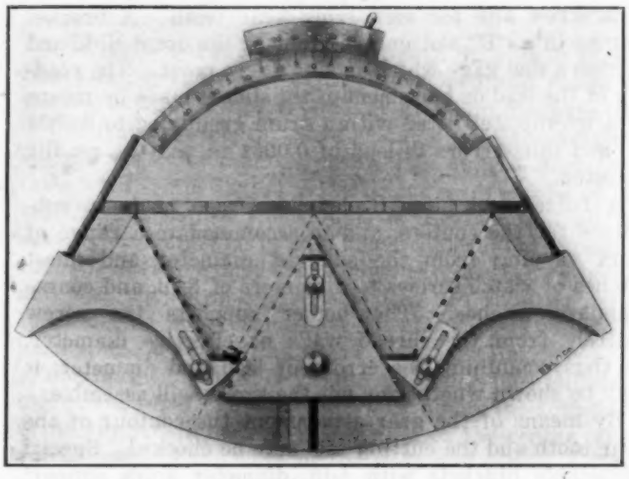


FIG. 2—ADJUSTABLE THREAD CHART

focusing is brought about by moving the object back and forth.

In the regular equipment are two focus objectives, a 24-mm. special objective in a long tapering mount of small diameter to work over the top of large diameter gages or threads, and a 48-mm. objective where less magnification or a larger field is desired. Eyepieces of 5 X and 12.5 X for projecting threads up to 3 T.P.I. U.S.F., and gears up to 12 diametral pitch are also included in the equipment. By lowering the table and thus increasing the projection distance, greater magnifications can be obtained. These magnifications, however, vary slightly with different objectives and eye-pieces and are not for use in taking direct measurements.

When projecting threads, the entire optical system is at all times lined up along a single central axis. The light source, the condenser, the portion of the screw to be projected and the objective are always part of a single coaxial system, and the screen receiving the image is always perpendicular to the axis of this system. Where the helix angle is large, the flank angle can be determined by calculation.

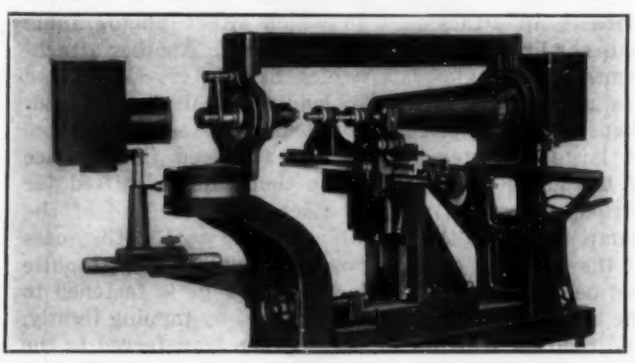


FIG. 3—CONTOUR MEASURING PROJECTOR WITH GEAR AND OPAQUE LOW-MAGNIFICATION ATTACHMENTS IN POSITION

The adjustable thread chart, shown in Fig. 2, is for very accurate measurement of threads. It has a graduated arc and vernier for checking the "lean" of threads and adjustable straight-edges which may be set by means of scales for any pitch and flat on the root of the thread, with a magnification of any desired value. It is set upon the table as shown in Fig. 1 and the contour of the threads is projected upon it.

The lead measuring attachment shown in Fig. 1 attached to the work-holding slide, is for checking the lead of a screw and for measuring gear teeth. A bracket clamps in a "T" slot on the front of the cross-slide and carries a dial gage which acts as a zero point. The reading of the lead or movement of the slide is made by means of a micrometer fitted with a drum graduated to 0.0001 in. and thus errors in lead of 0.0001 in. may be readily detected.

A holder and pitch blades have been made to substitute for the centers, and to accommodate a range of work varying from the smallest diameter and finest pitches of watch screws to diameters of 3 in. and coarse standard pitches. The holder supports the screw entirely from the thread walls or effective diameter. In thus combining the errors of lead and diameter, it may be shown whether or not the screw will assemble.

By means of the gear attachment the contour of the gear tooth and the cutting tool may be checked. Special adjustable brackets with ¼-in. diameter studs support the gears while an indexing pivot indicates the errors, tooth by tooth, over a number of teeth. By rotating the gears at an even rate, the rolling and sliding action of the teeth may be observed. In Fig. 3, the brackets and pivot are in position on the work carrier. Measurements of thickness and height of teeth can be taken to close limits with the lead measuring attachment.

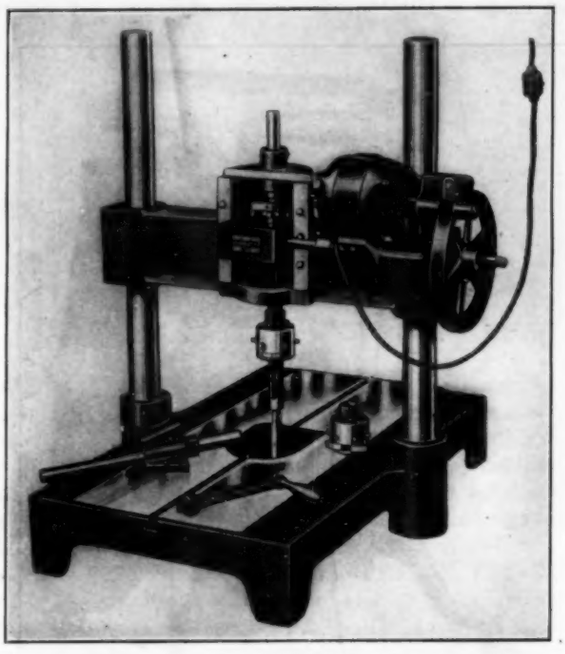
In measuring spur gears, the light may be passed along the tooth; but for spiral gears it is necessary to illuminate the work by oblique or normal illumination directed against the surface of the work being examined. Fig. 3 also shows the arrangement of a device for illuminating by oblique light. It is composed of a lamp house containing a 6-volt, 108-watt Mazda lamp fitted with a condenser, and is mounted on an optical bed. This arrangement can be used only for low-power objectives. The opaque attachment is for examining very small parts requiring high power objectives. The device, which consists of a vertical illuminator attached to the nosepiece of the optical tube, provides illumination normal to the surface under examination. With this attachment a 5-amp. arc lamp is substituted for the 6-volt Mazda lamp.

It is possible to take photographs of the image projected on the table and for use in this connection there is an attachment in which either photographic plates or bromide paper may be placed. Another attachment is the angle plate, which fits the cross-slide and has a clamping block for holding small flat or odd-shaped pieces in place, and a device for taking the casts of large diameter rings. Holes tapped in the face of the angle plate permit the clamp to be shifted for various diameters while the screw on the end of the clamp regulates the height according to the thickness of the ring. A cast composed of sulphur and graphite can be easily poured while the ring gage is fastened to the angle plate. The ring is loosened by tapping lightly, and the cast with its support is then transferred to the projector, where it is positioned properly in the V-block by a key on the support for the cast.

"Superior" Cylinder Reboring Machine

A machine for reboring automotive cylinders and designated as the "Superior" reboring machine, has recently been placed on the market by the Production Machinery Co., Jackson, Mich. The machine, which is shown in the illustration herewith, is of rigid construction and will handle any automobile motor cylinder or other internal combustion engine cylinder of similar design.

The machine consists of a bed-plate, to which the cylinder is clamped, and a cross-rail which carries the working parts. The boring bar is held between two centers, which prevents any deviation of the cutter from true alignment due to hard or soft spots, ports and clearances. It is stated that the construction also prevents the cutting tools from chattering while in operation. Both centers are made of tool steel, tempered and ground.



"SUPERIOR" CYLINDER REBORING MACHINE

The cutterhead is rigidly constructed, which also tends to insure perfect alignment where cylinders are out of round so that more metal must be removed from one side of the cylinder than the other. The cutter contains six blades, which are adjusted simultaneously by operating a hand wheel. All blades are made of high-speed drill rod and carefully tempered. They are ground to form a left-hand helix, which tends to draw away rather than into the metal. The machine is furnished complete with two cutter heads, which makes possible a range of from 2⅛ to 4½ in.; blades larger than this can be furnished if desired.

To locate the cylinder for boring, the bar shown lying on the table of the machine is placed between the centers and the locater is lowered into the top of the cylinder, where it is locked with a thumb-screw. This arrangement holds the cylinder in position until it can be clamped to the table by means of a T-bolt, after which the boring bar is substituted.

One of the features of the machine is the feed mechanism. Four different feeds are available by simply changing the position of the rollers with which the star

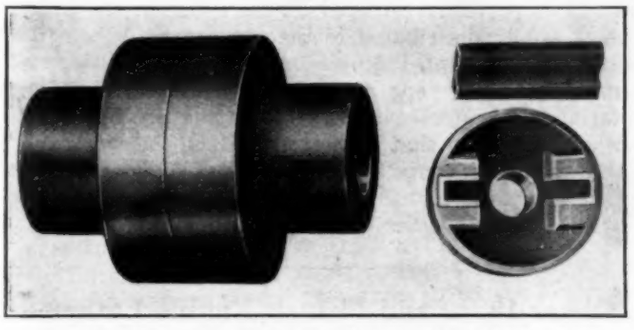
wheel comes in contact. Both the rollers and star wheel are hardened. The boring bar is driven by hardened steel helical gears, producing an even, constant feed.

The machine can be furnished either with an electric motor, as shown, or with pulleys for belt drive. The electric-driven machine is equipped with a ¼-hp. standard G. E. motor, for either 110 or 220-volt alternating or direct current, with cord and plug for connecting to a light socket, and a G. E. thermal switch which protects the motor.

"Tilting-Bar" Flexible Shaft Coupling

The "Tilting-Bar" flexible coupling recently developed and placed on the market by the American Foundry & Manufacturing Co., Frederick, Md., is shown at the left of the accompanying illustration. The coupling consists of only three parts, two flanged hubs with sockets in their faces and a steel bar that fits into the sockets. On the left of the illustration one of the flanges and the bar can be seen. Flexibility is obtained by the tilting and sliding of the bar in its sockets, so that parallel, angular and endwise misalignment of the two shaft ends can be accommodated.

Except for very slow-speed drive, the sockets are bushed with leather to furnish electrical insulation and to give quietness of operation. These bushings are impregnated with paraffin to make them water-proof and to lubricate the surfaces. The driving is done



"TILTING-BAR" FLEXIBLE COUPLING AND PARTS

through solid metal parts which are not subject to appreciable deformation, so that breakdown is not as apt to occur as when a number of springs and rubber pads are employed.

Due to the shallow V-shaped groove in the tilting bar there is a tendency for the two hubs of the coupling to move toward each other. The tilting bar is held centrally in one but is free to move endwise in the other. In this way the bar cannot be thrown out of center so as to cause a loss of balance and consequent vibration of the machine.

The factor of safety of the coupling is stated to be as high as 12, so that the shafts themselves would be twisted before the coupling would be broken. Due to the perfect balance, the coupling is suitable for the connection of shafts running at high speed. Parallel misalignment from $\frac{1}{16}$ in. in the smaller sizes to $\frac{1}{4}$ in. in the larger sizes can be compensated for. Angular misalignment of 7 deg. can be accommodated. Endwise motion, such as the float of an armature, is allowed also.

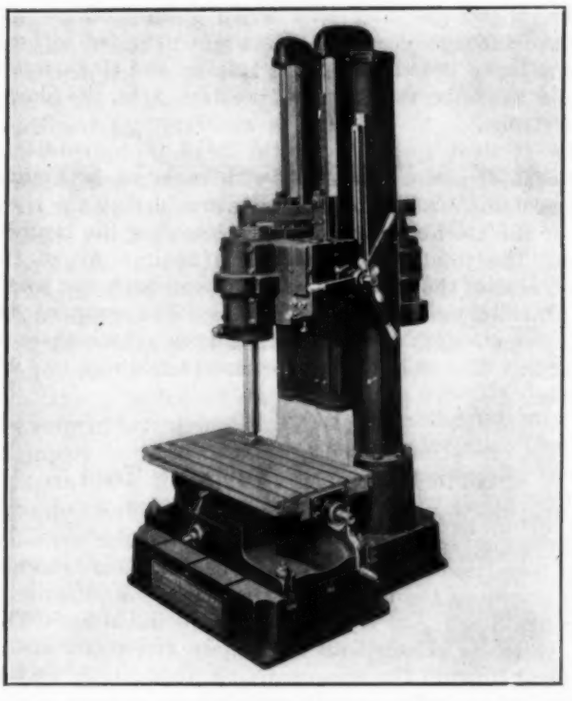
The coupling is ordinarily fastened to the shaft by means of one setscrew on top of the key and another at right angles to it. There are no projections on the outside of the flanges. The standard sizes in which the couplings are made are for shafts $\frac{3}{8}$ to $6\frac{1}{2}$ in. in diameter, although couplings for larger shafts can be furnished on order. The weight of the smallest size of coupling is 3 lb., while the weight of the largest is 1,080 pounds.

Williams Vertical Cylinder Grinding Machine

The Hy-Way Service Co., 225 South St. Joseph Street, South Bend, Ind., has recently developed and placed on the market the Williams cylinder grinding machine that is illustrated herewith. The machine is of the vertical-spindle type, so that the work lies on the horizontal table with the cylinders vertical. One advantage of the vertical position of the spindle is the fact that all the driving mechanism is located above the grinding wheel, so that the abrasive dust drops down through the cylinders and does not settle on the bearings and running parts. It should be noted that the vertical ways on which the head slides are protected by a canvas curtain.

The longitudinal slide of the table provides sufficient movement for positioning the work under the spindle to grind three cylinders on either side of the center without uncovering the ways of the slide and exposing them to the abrasive dust. After the work has been clamped on the table in approximately the correct position, it can be located under the spindle by the longitudinal screw and by the transverse screw operated from the front of the machine. The table mechanism with its movements is a separate fixture mounted on the base of the machine. The finished top of the table is 28 in. long and 18 in. wide.

The entire mechanism for driving the wheel is mounted on the wheelhead, which slides on the two widely spaced ways on the vertical double column. A 2-hp. General Electric motor is carried on the back of the head and serves to counter-balance the spindle



WILLIAMS VERTICAL CYLINDER GRINDING MACHINE

mechanism. It performs three functions, namely, driving the grinding spindle at the high speed necessary for cutting with an abrasive wheel, transmitting the planetary rotary motion to the spindle unit, and feeding the head downward to advance the spindle into the cylinder and then returning it to the starting position.

The motor drives at both ends. At the top of it there is a pulley carrying a fabric belt to transmit power directly to the grinding spindle. The speed of rotation is varied to suit the size of the abrasive wheel employed by changing the pulleys on the motor and the spindle, the speed being usually from 5,000 to 7,000 r.p.m. The spindle is mounted in a sleeve located eccentrically in another sleeve, the rotation of which gives a planetary motion to the spindle. A bevel ring gear on the outer sleeve is connected with the driving mechanism, so that power can be applied to rotate the sleeves independently of the rotation of the grinding spindle.

The two sleeves in which the grinding spindle is mounted are so arranged that by making suitable adjustments the eccentricity of the spindle from the center of the spindle unit may be varied from zero to 1¼ in. A graduated dial is provided to indicate the amount of eccentricity for any given setting. The range provided is sufficient for grinding practically all commercial sizes of automotive cylinders when grinding wheels of suitable size are employed, without the necessity of changing the pulleys. Holes as small as 2¾ in. in diameter can be ground to a depth of nearly 17 inches.

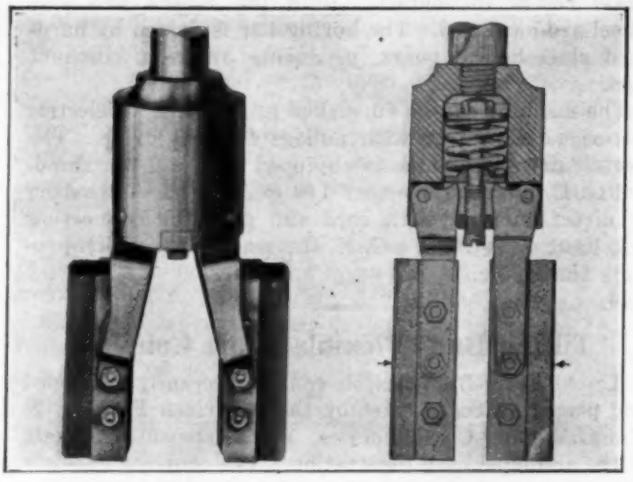
Power for imparting the planetary movement to the spindle is taken from a pinion at the lower end of the electric motor and carried through suitable gearing to the bevel ring gear on the eccentric sleeve. Two speeds of rotation are provided, one of 40 and the other of 60 r.p.m., obtainable through gearing and clutches by manipulating a hand lever on the left side of the machine.

The rate of feed of the wheel vertically into the work is susceptible to wide variation, as twelve rates of feed are available, ranging from 0.007 to 0.375 in. per revolution of the grinding spindle. All the changes are obtained through gearing. Stops are provided to limit automatically the travel of the spindle and to raise the spindle again to the starting position after its downward stroke.

The vertical operation of the head is accomplished by means of pinions meshing with racks on both sides of the column. A capstan wheel is provided on the right side of the machine for raising or lowering the head by hand. The total vertical travel is 28 in. All of the mechanism of the feed box runs in an oil bath, and oilers are provided on all sliding surfaces. The machine has an extreme height of 7 ft. and requires a floor space of 37x42 in. The weight of the complete machine is 4,000 pounds.

Storm Cylinder Finishing Tool

A tool for finishing the bores of automotive cylinders by polishing or burnishing action after the cylinders have been reamed, rebored or reground has recently been placed on the market by the Storm Manufacturing Co., 406 Sixth Ave. South, Minneapolis, Minn. This tool, which is shown both completely assembled and in sectional form in the accompanying illustration, may be driven by an ordinary drilling machine or by a special driving mechanism that can be furnished.



STORM CYLINDER FINISHING TOOL

The tool carries two abrasive stones of fine texture which rub against the bore when the tool is revolved, so that the surface is given a very smooth finish. The stones are held in contact with the cylinder wall by the action of the spring in the center of the body. The tension may be adjusted to suit different diameters of cylinders by turning the arbor in the center.

The spring is usually compressed to about 110 lb. pressure. This pressure is transmitted from the lower disk to the cams on the arms holding the stones. When the tool is perfectly centered in the cylinder, the pressure is evenly distributed to the two cams. When the tool is off center, all the pressure is transferred to one cam, so that only one stone bears against the work. Rotation of the tool naturally draws the driving block into such position that both stones touch the work and both cams are in contact with the disks. This centering action allows the tool to be operated at high speed. No universal joints nor flexible couplings are employed.

Oliver 10, 12 and 14-Inch Engine Lathes

To complete its line of engine lathes, the Oliver Machinery Co., Grand Rapids, Mich., has recently placed on the market 10, 12 and 14-in. sizes, so that machines ranging from 10- to 30-in. swing can be furnished. The lathe is made in both cone-pulley and geared-head, single-pulley types, a 12-in. size of the latter being illustrated. Straight or gap bed, bench or floor legs, oil pan and pump, and countershaft drive or motor drive can be furnished. The tool is for general use where an engine lathe for screw cutting is required.

The headstocks of the 10-, 12- and 14-in. lathes provide swings over the bed of 11, 13 and 15 in., respectively, and over the carriage of 8, 9 and 10¼ in. The cone-pulley headstock is of the bowl type and has three steps. It is provided with single back gears, so that six speeds from 25 to 500 r.p.m. are provided.

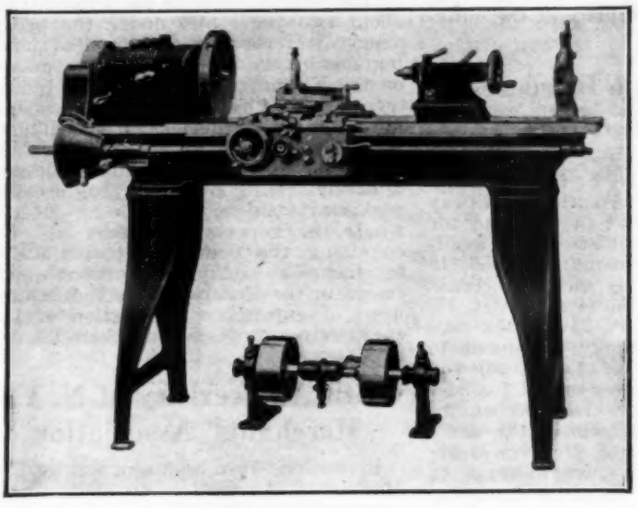
The single-pulley-drive geared headstock is fitted with steel gears that run in an oil bath. Six speeds ranging from 32 to 500 r.p.m. are obtainable by shifting two levers. A friction clutch is fitted in the driving pulley, so that the lathe can be started and stopped without the necessity of starting or stopping the motor or the driving belt.

The spindle runs in phosphor-bronze bearings adjustable for wear. In the two smaller sizes, a No. 2 Morse

taper is employed, and a No. 3 on the 14-in. size. The holes through the spindle are, respectively, 1, 1⅛ and 1¼ in. for the different sizes of machines. The diameter of the spindle nose is 1⅝ in. with 10 threads per inch on the 10- and 12-in. lathes, and 2⅛ in. with 8 threads per inch on the 14-in. lathe. The tailstock has a screw-operated set-over for turning tapers. This set-over, as well as the spindle, is graduated in sixteenths of an inch.

The bed is provided with three V-ways and one flat way. The standard lengths are 4 ft. 3 in., 5 ft. 3 in., and 6 ft., the lengths allowed between centers with the tailstock flush being 25, 36 and 36 in., respectively.

The carriage has a cross-slide travel of 6¾, 7¾ and 8 in., respectively, for the different sizes. The compound rest of the 10-in. machine carries a tool ½ x ¾ in. in



OLIVER 12-INCH SCREW-CUTTING ENGINE LATHE

size, while for the 12- and 14-in. machines, the toolholders can be ½ x 1⅛ in. The back of the carriage is machined and tapped, so as to receive a taper attachment for turning tapers up to 4½ in. per foot.

The apron gearing is so arranged that the operator may shift from thread cutting to either the longitudinal or the cross feed without the necessity of shifting gears. The two halves of the phosphor-bronze lead-screw nut can be closed on the lead screw only when the feed lever is in the neutral position, so that both the lead screw and one of the power feeds cannot be engaged at the same time. The lead screw is ⅝ in. in diameter and has five threads per inch. It is splined, so that the power feeds are operated by it.

The change-gear mechanism for the feeds is mounted on the left end of the lathe. The gears are slidably set on the end of the lead screw, so that they can be moved along to bring the proper one in mesh with the driving gear from the headstock. The range of feeds is from 0.0025 to 0.039 in. for all sizes of the machine, and all standard threads from 3 to 40 per inch can be cut. If desired, a small quick-change gear box can be furnished. The direction of feed may be reversed from the headstock without the necessity of stopping the lathe, reversing the direction of the spindle, or engaging or disengaging gears.

A countershaft can be furnished for either the cone-pulley or the single-pulley drive machine. The cone-head machine may be made self-contained by mounting a friction countershaft on a swinging arm at the rear of the headstock and fastening the motor on a bracket bolted to the leg. Means are provided for adjusting the tension of the driving belt. A countershaft may also be mounted for constant-speed-pulley drive, an arrangement that is applicable to the bench type machine. The geared-head machine may have the motor mounted directly on top of the headstock, or the motor may be mounted on the leg and belted to the driving-pulley.

A universal milling attachment can be provided for doing light milling work. A variety of attachments can be furnished, such as a follow rest, turret on either the carriage or the bed, draw-in attachment, chuck and metric lead screw and transposing gears. The regular equipment consists of large and small face plates, steady rest, compound rest, the necessary centers and a double friction countershaft.

The net weights of the three sizes of machine are 575, 875 and 1,300 lb. The boxed weights are 700, 975 and 1,400 lb., and the boxes have contents of 80, 90 and 100 cu.ft.

Test Questions for Hiring Employees —Discussion

BY S. N. BACON

Referring to page 141, *American Machinist*, Mr. Robert Grimshaw makes a suggestion for hiring employees which the writer does not believe would work out to very good advantage. Mr. Grimshaw would have us question the applicant as to whether he could operate a "Broynton" milling machine and if he replied yes, it would prove that he was not a milling machine operator or was at least unreliable. The writer believes the question is just as unfair as the answer and has in mind a period some years ago when he was considered a fairly good screw machine operator, experienced on Brown & Sharpe, Cleveland, Acme, Hartford, and Gridley automatic machines. Had the question been asked can you operate a "Broynton" screw machine he would have answered "yes" not because he would lie due to lack of experience but because his knowledge and experience of all the leading makes gave him enough confidence to tackle a machine he never heard of before. His experience on the Acme and Brown & Sharpe screw machines qualified him to operate a Universal screw machine without any previous experience.

A milling machine is composed of just so many standard operating parts and, if an applicant has had several years experience on Universal, Lincoln type and automatic milling machines, similar to the Pratt & Whitney, he is certainly justified in saying he can operate a Broynton or any other make. Another practice, which has been adopted by employment managers, while not exactly unfair, is at least an attempt at deception in advertising and is contrary to law in some states. This is the practice of inserting two advertisements and using different box numbers when the intention is to employ but one man for a particular job. The advertisements are worded differently so as to trap the applicant into writing two different letters of his experience. Chances are the applicant has really had all the experience claimed but it is not always to advantage to tell it all in an application for a special line of work. In these days of unrest let us use fair methods in securing employees and be that much surer of obtaining the best and lasting results.

News Section

Advancement in Mechanics To Mark National Exposition

The National Exposition of Power and Mechanical Engineering will open at 1:00 p.m. on Thursday, December 7, 1922, at the Grand Central Palace. It will immediately follow the Annual Meetings of the American Society of Mechanical Engineers and the American Society of Refrigerating Engineers and will remain open until December 13th, except on the intervening Sunday.

This Exposition will be the first large scale attempt to display mechanical and power plant apparatus so that the present extraordinary state of development will be apparent not only to the highly trained technical man but to the layman with little knowledge of the severe problems involved in the engineering design and operation of combustion apparatus and power-generating machinery. A very small percentage of the individuals in the world are informed about the tremendous importance of the engineering arts and sciences to our present civilization.

A detailed program of the Exposition as well as the programs of the A.S.M.E., A.S.R.E. and A.S.S.E., meetings will be announced in these columns at an early date.

American Foundrymen's Convention Announced

According to an announcement just received from C. E. Hoyt, secretary, the next annual convention of the American Foundrymen's Association will be held in Cleveland, April 30 to May 3, 1923.

In conjunction with the convention, there will be held an exhibition of foundry and shop equipment which, according to present plans, will take place in Cleveland's new public auditorium where, also, will be held the convention.

Work is already under way on the program which will be announced in full in these columns at a later date.

Tennessee Central Shops Destroyed by Fire

Fire of unknown origin, but believed to have started from oil ignited in the boiler room, destroyed the main shops of the Tennessee Central Railway, located near the corner of Hermitage and Fairfield Aves., South Nashville, Oct. 27, entailing a loss estimated at between $400,000 and $500,000. Insurance will cover part of the loss.

Originating in the room where the huge stationary engines are located for operating machinery in the various shops, the flames spread to every section of the big building, covering approximately one acre of ground. Located in the building were the machine shop, tin shop, tool rooms, planing mills, blacksmith shop and boiler rooms.

Four large locomotives, three freight and one passenger, were destroyed. Thousands of dollars' worth of equipment, machinery, tools and materials of all kinds are a total loss. More than 30 box cars standing on a siding near the shops were partially destroyed.

Late advices reaching *American Machinist* indicate the construction at an early date of a modern fireproof structure to take the place of the buildings destroyed.

Car Shortage Increases 10,000 in 7 Days

Reports received today from the rail carriers of the country by the Car Service Division of the American Railway Association show that the demand for freight cars over and above the available current supply amounted to 166,349 cars on Oct. 23. This was an increase of 10,040 cars over the total on Oct. 15.

The demand on Oct. 23 for box cars in excess of the supply amounted to 81,734, an increase of 4,623 over the total on Oct. 15. The demand for coal cars totaled 46,575, which was an increase of 1,591 cars within the same period. A shortage of 21,004 was reported for stock cars, an increase of 2,085 since October 15, while there was an increase of 1,717 in the shortage of refrigerator cars which brought the total to 9,348.

Reports also showed that at the same time 4,409 surplus cars of all descriptions and in good order were scattered throughout the country, an increase of 134 since October 15. Of that number, 1,776 were surplus coal cars. This was an increase of 188 since that date.

400 American Firms in China

In view of the recently approved China Trade Act, by which Congress has placed American firms operating in China on an equality, for the first time, with British, French and Japanese firms in the matter of taxation, the following tabulation of foreign firms and persons doing business in China is of especial interest. It has been received by the Department of Commerce from supposedly reliable sources in Shanghai:

	1914		1921	
	Firms	Persons	Firms	Persons
American	136	4,365	412	8,230
British	534	8,914	703	9,298
French	113	1,864	222	2,453
German	273	3,013	92	1,255
Japanese	955	84,948	6,141	144,434
Russian	1,237	56,319	1,613	68,250
Non-Treaty Powers	5	95	14	193
All others	68	2,289	306	3,653
Total	3,421	164,807	9,511	240,769

It will be noticed that the number of foreign persons has decreased from 351,000 to 240,769 since 1920. This decrease, however, resulting from the 1920 depression, is probably a healthy sign, for those who have weathered the storm are in the strongest position.

Reports Great National Interest in Technical Service

L. W. Wallace, executive secretary of the Federated American Engineering Societies, has completed a coast-to-coast tour, during which he set in motion plans for Federation expansion. Stressing the great influence exercised by the Federation since its organization about two years ago under the presidency of Herbert Hoover, and evidencing this by the report of its Committee on the Elimination of Waste in Industry, as well as by the report of the Committee on Work Periods in Continuous Industry, as well as by other sustantial achievements, Mr. Wallace was attentively heard by large engineering gatherings in many cities. Everywhere, he reports, engineers are recognizing the enormous potentialities for technical and public service which reside in the Federation as the instrument of expression and action of the engineering profession in America.

25th Anniversary of N. Y. Merchants' Association

Invitations have been sent out by The Merchants' Association to all business houses in the city which have been in business uninterruptedly for one hundred years to send representatives to the mass meeting which will be held at Madison Square Garden on Nov. 17 to celebrate the twenty-fifty anniversary of the Association. If Mrs. Harding's health permits him to leave Washington, President Harding will address the meeting. While many houses have suffered changes of title during a century of existence, it is believed that a considerable number exists in the city.

Car Loadings Establish Record for 1922

A total of 1,003,759 cars were loaded with revenue freight during the week which ended on October 21, according to reports received today from the rail carriers by the car service division of the American Railway Association.

This was the largest number of cars loaded during any one week in two years. This also was within 14.780 cars, or one and five-tenths per cent of the greatest loading in the history of American railroads, which took place during the week of October 15, 1920.

The total for the week has only been exceeded four times in history, all of which took place in the fall of 1920 and are as follows:

September 24	1,008,109
October 8	1,011,666
October 16	1,018,539
October 27	1,008,818

Loading for the week of October 21 this year was an increase of 20,289 cars over the preceding week.

The Business Barometer

This Week's Outlook in Commerce, Finance, Agriculture and Industry Based on Current Developments

By THEODORE H. PRICE
Editor, *Commerce and Finance*, New York

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THE price movement on the New York Stock Exchange is a factor in our economic complex that the American business man cannot ignore. There are 2038 daily newspapers in the United States. Of these a large majority publish the Stock Exchange quotations and whenever the fluctuations are at all unusual or sensational attention is called to them with "scare heads."

The result is that business sentiment from the Atlantic to the Pacific is more or less attuned to the ups and downs of Wall Street, whch are often otherwise unimportant. This is to be regretted, but it is a fact that we cannot disregard. Attention is called to it because the prevailing commercial optimism seemed to be somewhat chilled early last week by the continued decline in the stock market.

This decline, which had been in progress since September, seems to have culminated temporarily at least, on last Monday. On that day 478 different stocks were traded in on the Stock Exchange and some of them sold 20 or 30 points below the high record of the summer. On Tuesday, when business men read their papers they commenced to say "We don't like the weakness of the stock market" and nearly all the commodity markets became reactionary. By Thursday the stock market had made a substantial recovery, the merchants who had become apprehensive were reassured and as the week ends confidence in the future seems to be completely recovered.

But the sympathy between the commercial and financial markets is not entirely logical. Almost without exception the trade reports are optimistic. If the predictions made are realized the banking resources of the country will be fully employed in financing the distribution of goods.

Moreover, gold is commencing to leave us. Since the 1st of October $17,000,000 has gone to Canada, as the Canadian dollar is slightly above par. The reserve ratio of the Federal Reserve System is slightly lower at 76 per cent, as compared with 77.6 a week ago, the gold on hand shows a decrease of $7,000,000 and the total of bills discounted has increased by $121,000,000. This all points to higher interest rates, which do not favor stock speculation. Therefore it is to be doubted whether the expected improvement in mercantile business will be permanently accompanied by a buoyant stock market. Railway securities may and probably will sell higher, but a renewal of liquidation rather than further buying of the highly speculative industrials seems to be indicated.

But of commerce and industry the converse is predicted and the outlook seems to justify the prediction. There is in the first place the theory of a secondary inflation. It is not yet generally excepted. Some influences are at work to prevent its becoming an actuality, but deflation is unpopular at present and the credit expension in progress is not likely to be arrested until the reserve ratios are much lower and the elation caused by high prices has carried the business community off their feet. This is unfortunate, but it is human and we may as well face the facts.

Meantime those who talk about inflation should remember that only three important raw products are as yet much above their prewar value. They are cotton, wool and paper.

The boll weevil has put cotton up and he will probably keep it up until some way to destroy him is found. Whether the advance will check the consumption of cotton goods remains to be seen. Some authorities fear it may, but thus far the domestic demand shows no signs of abatement and the export movement of raw cotton is again increasing. The advance in wool is directly due to the tariff, which is not likely to be changed for some years.

The demand for paper, which is really phenomenal, reflects the increased circulation of the newspapers as well as the growth of our reading and advertising habits. They are national characteristics that are likely to become more marked as each year passes.

As to the other staples—wheat, corn, oats, rice, sugar, tea, coffee, meat, iron, steel, copper, rubber, leather, lumber, building materials and petroleum—they are none of them in the raw state much above their prewar prices.

Roughly speaking, it is probable that in so far as the industrial classes are concerned their purchasing power and the cost of what they have to buy is closely equated, but this is not true either of the farmers or of clerical workers and it is from one or both of these groups that we shall probably hear the first effective protest against the rise in the cost of living now in progress. For it the careful merchant should be on the alert.

The "overall parade" that everyone ridiculed was the prelude to the "buyers strike" that commenced nearly three years ago and it may be that something equally trivial will be the signal for the next recessional of what we call prosperity.

There are other contingencies that should not be lost sight of. Tuesday's election and its effect upon the minds of the people and the policy of the government are to be considered.

The decline in the German mark to 1⅛ cents a hundred, which seems to indicate that all hope of rehabilitating the credit of the German government has been abandoned, is another development that suggests caution.

Still another is the cost of coal to the small consumers in the large cities. It appears to be again rising to extortionate figures despite the vigilance of the various coal commissioners who have little or no legal power over the unscrupulous profiteers.

A high authority has enjoined us to "beware when all men speak well of you" and as an antidote to over-confidence this advice should not be forgotten in times of prosperity and expansion.

All the indicia of business are now favorable. Postal receipts, car loadings, railway traffic, the sales of mail order houses and department stores, bank clearings, the output of automobiles and most other statistics indicate an increased and increasing volume of business.

But these statistics have reference chiefly to the past and it is for the invisible and the unknown that we must make allowance. When we were in the depths of depression it was safe and wise to rely upon a return to normal, but now that we are getting into a higher altitude we should not foreget that there is a level at which the air becomes so rarified that breathing is difficult.

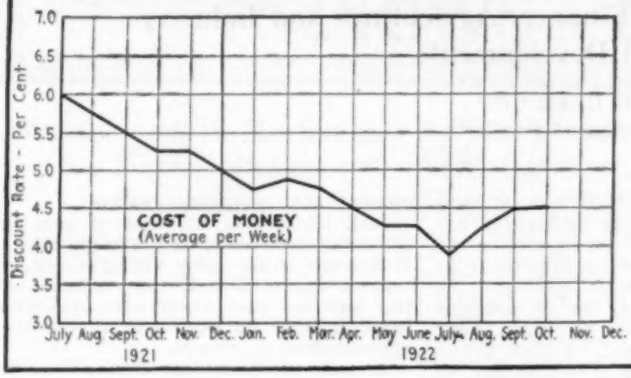
Big Year Ahead for U. S. Manufactures

American manufacturers are evidently preparing for an exceptionally busy season both in their domestic industries and the export trade. In fact, says the *Trade Record* of The National City Bank of New York, they are in many cases doubling their importation of raw material as compared with conditions a year ago, while on the export side manufactures are the one group of articles which shows an increase in exportation while other groups show a decline.

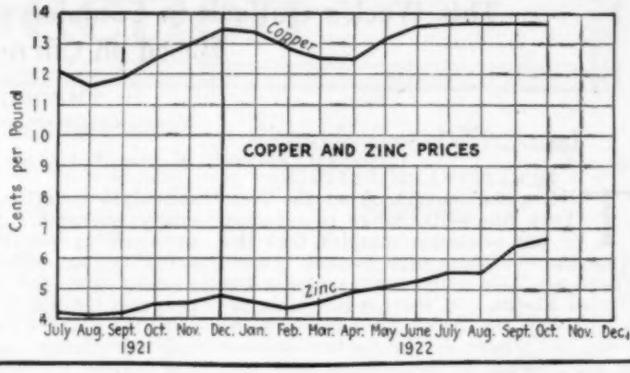
Manufactures exported in the month of August, the latest month for which we have official figures in this detail, showed an increase of 15 per cent in value when compared with the same month of last year, while the other articles exported showed a reduction of over 33 per cent in value in the same period. The few figures thus far received on September exports indicate that the record of that month will also show a heavy fall in exports of non-manufactured material, and probably an increase in manufactures exported.

The startling factor in the activities of the manufacturers at the present moment is in the tremendous increase in their importation of raw material. Practically every important article for which our manufacturers require foreign material shows a large increase in the quantities imported in August, 1922, when compared with those of August, 1921.

Average weekly rates for 60 and 90 day commercial paper based on daily New York quotations furnished by the Journal of Commerce.



Average of New York weekly quotations on electrolytic copper and zinc as reported by Engineering and Mining Journal-Press.



Cost of money as reported from the various points in the Federal Reserve System shows a firmer and higher tendency. City and country banks have been in the market for prime commercial paper and an excellent demand has been in evidence with fairly liberal offerings. The range in rates in October has been between 4½ to 4¾ per cent as compared with an approximate range of 4 to 4¼ per cent in the previous month.

Equipment shares fell off during the month from the high point reached in the middle of September, the average price of 10 representative issues dropping to $106.50 as compared with $110.40 in the month previous. The decline has been largely speculative in character with profit taking in evidence. There has been a feeling of caution manifest in various quarters with a disposition to look upon the market, as a whole, as having reached the end of the upward swing which started some months ago and which has been serenely under way since that time. Nothing at the present moment, however, indicates a drastic reaction.

Copper and zinc prices, on the average, show but fractional changes during October. The average price on the New York market for the former was 13.632 cents as against 13.748 cents in September. Zinc averaged 6.840, an increase from 6.110 cents. Buying at the present time is very dull both for domestic and foreign account. January deliveries are being named in copper, this years wants apparently being satisfied. In export an increased demand has developed from France. Zinc producers report an excellent demand with prices stronger and higher. Active European buying has been in evidence recently.

Comparative Prices of Shop Supplies

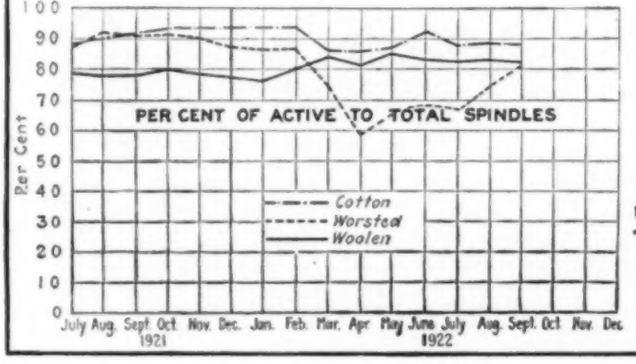
Average of New York, Chicago and Cleveland Prices

	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars..	per lb.....	$0.0295	$0.0285	$0.0273
Cold finished shafting.....	per lb.....	0.0378	0.0373	0.0379
Brass rods.....	per lb.....	0.171	0.1700	0.148
Solder (½ and ½)	per lb.....	0.23	0.228	0.20
Cotton waste..	per lb.....	0.11	0.11	0.122
Washers, cast iron (¼ in.)...	per 100 lb.	4.33	4.33	5.00
Emery, disks, cloth, No. 1, 6 in. dia.....	per 100.....	3.11	3.11	.....
Lard cutting oil	per gal.....	0.575	0.575	.....
Machine oil....	per gal.....	0.36	0.36	.....
Belting, leather, medium.....	off list.....	40–5% @50%	40–5% @50%	
Machine bolts up to 1 x 30 in.	off list.....	55% @60%	50%@ 65–10%	50%@ 60–10%

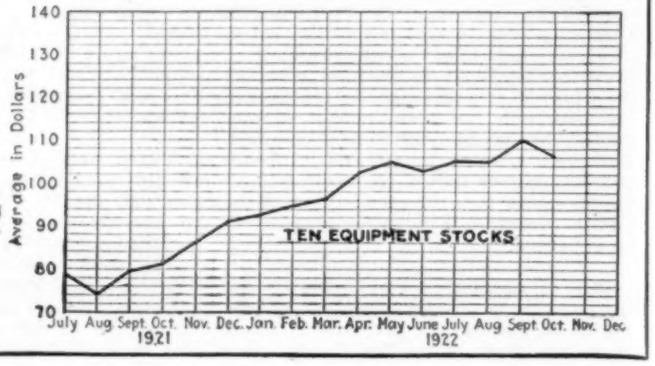
Textile industrial activity in the United States during the month of September compares favorably with the month of August, October figures not yet being available. Cotton spindleage active amounted to 89.8 per cent of the total in place as compared with 87.9 per cent in August. In the woolen industry there was a slight decline from 82.9 per cent to 81.7 per cent. Worsted conditions, on the other hand were better, active machinery amounting to 81.4 per cent of the total in place as compared with 74.8 in August. The demand for woolens and worsteds continues steady. Cotton yarn prices are strong and rising. Exports of cotton cloth continue ahead of last year.

Employment in industries, according to the Department of Labor, shows that in September as compared with August, there was an increase of 10 per cent in foundry and machine shops. Within the same period there was also an increase of 9.5 per cent in the total payroll disbursements and an increase of 0.5 per cent in per capita earnings. In the iron and steel industry per capita earnings increased 9.5 per cent, employment showing a slight decrease of 1.9 per cent. The electrical industry shows a 2.2 per cent increase while employment in farm implement manufacture declined 4.4 per cent.

Monthly percentage of active cotton, woolen and worsted spindles to the total in place as reported by the Bureau of Foreign and Domestic Commerce.



Monthly average: Am. Brake Shoe; Am. Car and Fdy.; Am. Loco.; Baldwin; Lima Loco.; N. Y. Airbrake; Pressed Steel Car; Pullman; Ry. Steel Spring; West'h'se A'Brake.



Business Conditions in Germany

Labor Still a Disturbing Factor—Steel Industry Shows Improvement—Tool Builders Operating on Part Time

By OUR BERLIN CORRESPONDENT

THE gradual decline of business, already noticeable during the first months of the summer, has, after a brief spell of revival, caused by the unprecedented money depreciation, taken sharp dimensions in the middle of September. The depression, signalled by a sharp falling off in incoming orders, has seized simultaneously nearly every line of industry and all stages of manufacture. Buying has nearly come to a standstill, not only with the ultimate consumers, but also with the whole chain of middlemen.

As a sign of the times there may be mentioned the almost complete failure of the last Leipzic fair in August, which started under the most favorable auspices. The numerous buyers it had attracted, have scurried away in haste after hearing prices and left the field practically to the salesmen. As a comprehensive test of market conditions, the Leipzic fair stands supreme. The lesson it teaches is, that prices have reached a level, upon which, at least the domestic market will not follow.

Fall of Mark Demoralizing

A general view of the situation shows, that the carefully preserved position, which Germany occupied in the matter of cost and labor in contrast to surrounding countries and the rest of the world, has been seriously weakened. In a discussion of German labor conditions, published in these columns, the situation has been likened to a vessel, allowing Germany to produce under a lower pressure of cost than in the rest of the world. There can be no doubt, that this vessel has now sprung a serious leak. Prices, which at first kept at a considerable distance from those of the outside world and were only slightly, and never immediately, influenced by exchange fluctuations, are now closely linked with the latter.

The paper mark has lost its capacity as a price unit and surrendered this position to the dollar. The growing tendency to substitute paper marks as a basis of prices by the dollar has, although strongly opposed in actual practice, established itself in virtue. The situation in this respect is one of extreme gravity. Prices are following almost instantaneously every upward move of the dollar exchange, but nothing short of a slump can effect their downslide. Almost the same can be said of wages. The distance, at which the cost of labor has been following the rise of living cost, has gradually diminished.

Apart from the seriousness of the labor question, the position of the industry has become very precarious in other respects. The chief difficulty is pronounced to be the shrinkage of working capital and the extreme tightness of credit. Recent visitors to Germany were greatly non-plused by the inability of the banks to cash checks of even small denominations. This was explained to the public as due to the printers' strike, a rather absurd explanation, remembering that this strike dated months back and lasted only 10 days. The fact is, that wages, salaries and other cost have risen so enormously, that the currency available has become insufficient. In many parts of the country factories could not pay their employees in full.

The situation will be understood, when considering that the whole floating debt of the country of 350,000 million marks is now only worth 900 million goldmarks in comparison to 6,000 million in pre-war times. The depreciation of the money has run far ahead of the inflation, and by compelling the latter to follow, it becomes stabilized in its turn, a very natural consequence.

TABLE I—GERMAN FOREIGN TRADE IN MACHINERY

For First Seven Months of 1922

	Imports			Exports		
Month	Tons	Value (Millions of Marks)	Price per Ton (Marks)	Tons	Value (Millions of Marks)	Price per Ton (Marks)
January	1,010	27	26,700	32,695	927	28,400
February	656	19	29,100	39,257	1,255	32,000
March	1,480	19,4	13,100	40,247	1,465	36,000
April	778	24,5	31,000	39,418	1,586	40,000
May	402	10,9	27,000	40,497	1,614	40,000
June	1,519	31,8	21,000	41,527	1,909	46,000
July	776	30,3	39,000	36,381	1,761	48,000

The iron and steel industry showed during August even increased business in comparison with July, caused by the rush upon the market for covering in raw material in view of the quickly rising price level. Shortage and lower quality of fuel have further reduced the capacity of this industry. Scarcity of ore compelled imports of pig iron to an ever increasing extent, which precipitated the rise of prices of machine building material. The last adjustment has decided upon the following maximum prices of iron and steel: cast iron 26,500 marks per ton, mild steel 29,200 marks per ton, ferro manganese 80 per cent 72,700 marks per ton. These prices are not firm, but keyed to the price of coke in such way, that for instance in the case of ferro manganese an increase of 2.70 mark per ton comes automatically in force for every mark the price per ton of coke increases. Of steel products, Siemens Martin bars have now arrived at 63,000 marks per ton, crude sheets from 70,000 to 75,000 marks per ton, gage sheets from 86,000 to 159,000 marks per ton.

Tool Builders Working Part Time

The labor gazette reports that a number of machine building factories had to reduce working time not only on account of shortage of raw material, but because manufacturers were unable to find the money required for buying sufficient stock. According to the labor gazette a general decline of the machinery market outlined itself quite clearly during August.

This is especially true of the machine tool building industry, which as a rule is the barometer of the whole machinery market. Reports from various factories in different parts of the country agree, that a certain slackening of business took place during August. The machine tool trade, which feels the pulsation of the market better and quicker than the works themselves, noticed this change at a considerably earlier date and was viewing the outlook with misgivings at the time when in factories an optimistic tone still prevailed. It is peculiar to note that the first complaints heard of diminishing orders concerned the export and not domestic business. Coinciding with the rapid drop of the mark, this is very significant.

The large amount of orders still in hand is sufficient to keep the machine tool industry employed for a time, varying between two and seven months according to different lines and quality of production. A certain reduction of delivery dates is already noticeable, but for leading makes and a number of lines, like automatics, universal milling machines and heavy tools, quotations are heard for no less than from 5 to 6 months. Standard tools, like lathes of current sizes and plain milling machines, can be frequently had from stock or booked for delivery in 4 to 6 weeks. This is not so much due to the recent slump, which has not had time yet to take strong effect, but to the largely increased output of such tools.

Difficulties in Financing

The complaints heard in other fields of the enormously high cost of production, making the financing of the orders in hand more and more difficult, are not so frequent in the case of the machine tool building industry, but by no means absent, especially amongst the weaker members of the fraternity. In addition to these, complaints are heard of considerable delays in the supply of raw material and even of shortage of labor, especially trained hands. The latter is the result of the labor policy, which has nearly equalized the payment of trained and untrained labor and caused the first to seek employment in better paid lines of work.

Prices of machine tools have continued on their upward move, as is indicated by the directions issued by the German Association of Machine Tool Builders. The increase thus directed over the prices of November, 1921, which were from 15 to 30 times above pre-war level, are the following: December, 37 per cent; January, 42 per cent; February, 61 per cent; March, 87 per cent; April, 143 per cent; May, 190 per cent; June, 225 per cent; July, 294 per cent; August, 460 per cent; September, 980 per cent.

As can be seen, prices are for the time being approximately ten times higher than those of last November or

from 150 to 300 times above pre-war level. For October a further large increase is imminent. Wages are following the rise of prices at a certain distance, but their movement is gathering momentum. The minimum weekly wages for a trained machinist, which in July were 1,400 marks, have in August increased to 1,900 marks, and from the end of August to 3,000 marks or 70 times the pre-war average. This applies to conditions in Berlin. In some parts of Germany wages are somewhat lower and in others higher. It is interesting to note how little the wages for trained and untrained hands differ. The average wages for married trained men in Berlin in August were 1,962 marks per week, while an untrained man earned 1,830 marks or only 6½ per cent less. During September a further increase of wages of 30 per cent took place, and a rise of at least the same extent is already announced for October.

Position of Machinery Exports

In the German foreign business, which up to the end of July has accumulated a large balance on the wrong side, machinery exports form one of the most favorable features. In the case of machinery, the surplus from January to July was somewhat above 10,000 million marks. The figures shown in Table I taken from the official statistics, represent the returns of the foreign business of machinery during this period.

It can be seen that imports remained on the whole stationary, while exports show a steady increase up to June, followed by a considerable drop in July. Of imports, only a few classes run up to a larger amount, as, for instance, locomotives, weaving machines, harvesters and machine tools, which amounted to 1,103 pieces weighing 918 tons or nearly 15 per cent of the total. The imports appear even smaller when considering that a part of them comes from territories, like Danzig, politically detached from Germany, but economically still belonging to her. This applies for instance to the case of locomotives.

It is of interest to observe the prices per ton of machinery exported and imported. The fact that the average ton price is lower in the case of imported machinery is to be explained by the large percentage of imports from former German territories and countries with still weaker exchange, like for instance Austria. The average export price in January was approximately 28 times above pre-war level at a ratio of money depreciation of 1 to 45. By July the price had increased to 48,000 marks per ton, or 48 times the pre-war price. The corresponding ratio of the money exchange was during that month 1 to 110. Export prices have, therefore, not kept step with the drop of the mark. Compared to pre-war standards, exports remained only slightly behind those of 1913. The best return in comparison with that year is shown in the cases of locomotives, the export of which exceeds by far that of pre-war times, harvesting machines, blowers and ventilators, and machines for the leather industry. In a number of other cases it keeps approximately to the pre-war level, like cranes, sewing machines, machine tools, wood working machinery, printing presses, pumps, hoisting machinery. In all other cases, exports are more or less below pre-war level. The drop is especially marked in the case of textile machinery. The decrease in the grand total would be more strongly pronounced if deducting locomotives therefrom, the growing export of which is the balancing fact.

The figures shown in Table II represent the imports and exports of machine tools from January to July, 1922.

The imports show in the average a slight increase, but their total from January to July of 918 tons or 115 tons per month remains far behind that of 1913, when the monthly average was over 600 tons. In view of the difficulty standing in the way of such imports, not only of a financial nature, it is significant that they have already run up to 25 per cent of the pre-war level.

As to countries of origin, Holland sends the largest share, the United States, Switzerland and Austria following. The respective figures (January-July, 1922) are the following: Holland, 383 tons; United States, 139 tons; Switzerland, 115 tons; Austria, 81 tons; all other countries, 200 tons. The machine tools imported from Holland are, of course, not of Dutch make, but probably English or American, obtained through Dutch dealers.

TABLE II—GERMAN FOREIGN TRADE IN MACHINE TOOLS

For First Seven Months of 1922

	Imports			Exports			
	No. of Tools	Tonnage	Value Millions of Marks	No. of Tools	Tonnage	Value Millions of Marks	Prices per Ton
January	....	135.4	5.67	.....	6,897( )	173,9	25,000
February	....	62,5	3,6	.....	7,336( )	178,3	24,300
March	....	110	2,2	.....	6,852( )	184,8	27,000
April	124	164	3,9	9,837	4,486	185,5	41,000
May	118	69,7	2,5	8,067	3,496	173,5	49,600
June	361	253	4	9,560	3,918	210	53,000
July	103	124	6	9,376	2,983	181,8	61,000

Tool Prices Below Pre-War

Taking into account the number of tools imported, a tendency towards lighter types is exhibited. The same also applies to exports. In the Table II, the export returns of the first three months, marked (x), contain wood and stone working machinery, which, up to April have been listed with machine tools proper. Even so, it is clearly recognizable, that in the course of the year machine tool exports have dropped in weight if not in numbers. Below the ad valorem figures have been placed the average prices realized per ton, which allow interesting conclusions, when comparing them with the ratio of money depreciation and the sales prices directed by the Association of German Machine Tool Builders, in whose hands the export control rests. From January to March the price per ton hardly changed, although the mark dropped during that time from 200 to 280 to the dollar. An increase becomes noticeable from April to June, although the mark during this period remained almost stable, the further drop in July is not reflected in the ton price of this month.

A similar discrepancy is exhibited by comparison with the increases directed by the Machine Tool Builders' Association. On the average, the export prices realized are from 50 to 60 per cent of pre-war prices. Among the countries purchasing German tools, Belgium stands foremost, Italy, Spain, France, Holland, Austria and Checho-Slovakia following. Small Austria is still buying to nearly half of the extent of the former Austro-Hungarian Empire. Exports to Belgium, Italy and Spain exceed those of pre-war times. A good recovery is exhibited in the case of South American countries.

As a sign that an impending decline of business was anticipated in quarters capable of a general survey of conditions may be taken the increased attention to the problem of reparations in kind. The much discussed Stinnes contract is a first step in this direction, and the eagerness, exhibited in industrial circles, to follow this example or to join in the business, is significant. Similar contracts have been concluded by another large engineering combine and by a group of South German manufacturers of the metal working industry, including several machine building works. According to newspaper reports, a further number are in the course of preparation, amongst which may be mentioned a project initiated also under Stinnes' guidance for a combine between French iron ore producers and German steel works.

A certain danger is seen in the way the problem of reparations in kind is being put into effect, as it tends to further trustification on a large scale. It is expected that the German combines, which have taken the matter in hand, will make every effort to realize the best possible prices, i.e., the French market prices, which would seriously react upon German domestic prices, not to speak of the shortage, which would ensue from large quantities of goods extracted from the German market.

The keen interest given to the reparations problem is also significant for the disappointment felt after the expectations based upon the opening of the Russian market. From reports issued by the Soviet Government it appears that Germany has by no means captured the lion's share of Russian foreign trade and that the latter falls to Great Britain. The by far greater capacity of the latter country of financing such business is held responsible for this fact, and the growing difficulties of Germany in this respect have in the course of time greatly reduced even moderate expectations.

Employment Service for Engineers

The skilled technical man seeking employment as well as the executive in search of high grade help will find the employment bureau opened by the four national Engineering Societies, the offices of which are at No. 29 West 39th St., New York City, of great value. Members of many affiliated societies and organizations are available through this service bureau.

The service is free and parties interested are requested to communicate with W. V. Brown, manager, Employment Service, Engineering Societies' Building, No. 29 West 39th St., New York City.

Washington Notes

By Paul Wooton

In Europe today the greatest problem is that which has as its object the creation of a spirit for peace instead of a spirit for war. There are other problems of magnitude but in no case can their amelioration be purchased, either by the United States for giving the debts owed it by the European countries, or any other way. Their solutions lie in the moral, intellectual and spiritual fields. Incidentally it is the opinion of high officials in Washington that these problems should be solved singly. Effort to solve the problems jointly makes compromise inevitable.

That the United States ultimately will get back the capital sum involved in these loans to Europe, is the opinion held in a most authoritative official quarter. No one of the nations which entered into this obligation could continue to hold up its head and refuse to meet that debt. Its repayment is held to be a moral obligation to the American taxpayers.

Costly Militarism at Fault

No weight is given the argument that the United States should write off these obligations in an effort to compensate for its failure to enter the war in 1914. Those who have made a close study of the situation decline to admit that the United States was at fault for not having entered the war at that time. They hold that this country in taking up arms against Germany was actuated principally by a desire to prevent the collapse of civilization and to save Europe's drowning liberalism. In that connection it should be pointed out that the most reactionary American is more liberal than the most liberal European.

A reduction of the French army by 50 per cent would pay that nation's debt to the United States. In other countries as well it is held that there is nothing to justify military expenditures at the present rate. Were the United States to maintain military forces in the same proportion as is the case today in Europe, its standing army would be 1,000,000 strong. Even our economic system could not stand such a shock.

With Europe in a higher state of productivity than ever before, it would be little short of picking the pockets of the American taxpayers to cancel the debts, particularly in view of the ease with which the payments could be made were unnecessary drains on fiscal finance stopped. Moreover the United States has reached the point where its surplus of gold no longer is large. Month by month the balance of trade against us is diminishing. We may be exporting gold before six more months have rolled around. In 1921 a billion dollars of American money was loaned foreign industry. That rate is not being maintained this year, but even so the disproportion in the holdings of gold by the United States is about to disappear.

Sterling bids fair to be up to gold value in eighteen months. When that point is reached, it means that 85 per cent of the world's commerce will be on a gold basis. That will make for stabilization in some of the other currencies. There can be, of course, no hope for a return to normal in the exchange with countries which continue to publish money.

Mechanical Engineers Wanted

The United States Civil Service Commission in an announcement just issued, states that it will receive applications until December 5 to fill positions of inspector (mechanical) at the Naval Station, Pearl Harbor, T. H. The pay offered is $7.20 a day with an additional allowance of 96 cents a day while employed at the station. Transportation is furnished by the Government.

Competitors will not report for a written examination, but will be rated upon the subjects of technical education and preliminary experience (30 per cent) and special experience and fitness (70 per cent).

A degree in mechanical or electrical engineering from a recognized college or university and at least three years of certain specified experience are required, except that seven years of experience in mechanical engineering will be accepted in lieu of a college course.

Full information and application blanks may be obtained from the United States Civil Service Commission, Washington, D. C., or the United States civil service board at the post office or custom house in any city.

German Secret Solved in New All-Metal Plane

A secret metal developed for German aircraft during the war has finally been successfully applied to what is said to be the first American-built, all-metal airplane to fly in this country. The metal, known as "duralumin" because it consists mostly of aluminum, has hitherto given trouble in the final processes of manufacturer upon which its strength and life depend.

Duralumin is used throughout in the "Batwing" airplane, the successful flying of which was announced last night by the inventor, Wm. B. Stout of Detroit, at a meeting of the Metropolitan Section, Society of Automotive Engineers.

As its name indicates, the batwing plane has a single wing shaped like that of a bat. But the spruce wood used in practically all aircraft to date has been replaced by structural members of duralumin, instead of cloth wing-coverings, the new machine has a duralumin skin, only a fiftieth part of an inch thick. Even the struts and cables used for bracing are now contained in the so-called thick-wing.

The eventual airplane, according to Mr. Stout, will be practically nothing but wings. Continuing he said:

"In a comparatively few years, wooden airplanes in the air will be scarcer than wooden ships on the sea. All airplanes flying under insurance rulings will be of all-metal construction.

"Metal planes mean greater safety to pilot and cargo; a possibility of considerably lighter weight; less production cost, particularly as the demand increases; and easier repairs.

"Thick-wing airplanes are developing fast, both in monoplane and biplane types. Retractable chassis, wing-type radiators, and other features that the recent Pulitzer races have shown to be practicable, will appear shortly in commercial airplanes and increase their profit-paying possibilities."

Business Items

The Black & Decker Mfg. Co., Towson Heights, Baltimore, Md., has made the startling announcement of a reduction of $11 in the price of their Standard quarter-inch electric drill. They make it clear that this is the same machine which has been selling all this year at $39, although this machine is being constantly improved. The latest improvement is the supplanting of the hand chuck by a three-jaw geared-nut chuck. Production of these drills has trebled with the result that they are now able to sell them at $28.

The Herberts Machinery and Supply Co., 3rd and San Pedro Sts., Los Angeles, Cal., has been appointed exclusive representative by the Diamant Tool and Manufacturing Co., Inc., 91-97 Runyon St., Newark, N. J., in connection with the sale of Diamant standard punch and die sets, in the territory covered by the entire states of California, Arizona and Nevada.

The Natlay Chain Corporation, New York, has been incorporated by B. M. Bancroft and W. Hutchinson, with a capital of $100,000 to manufacture a patented steel chain as well as other mechanical equipment.

The Joyce Manufacturing Co., 2970 Jefferson Avenue, Detroit, Frank H. Joyce, president, recently incorporated with a capital of $500,000, has leased a factory building in that city and will manufacture automobile equipment.

The General Tire and Rubber Co., Akron, Ohio, will spend $100,000 on additional tire making machinery in connection with contemplated factory expansion.

The Firth-Sterling Steel Co. announces that it has added to its line of products the Globe polished drill rods drawn by the Globe Wire Co., Sharpsburg, Pa., and will carry stocks in its warehouses in New York, Boston and Philadelphia.

The Western Screw-Products Co., St. Louis, Mo., whose plant was destroyed recently by fire, has secured a new and permanent location at Main and St. George Streets, that city, and are engaged in equipping it with modern machinery. Production is expected to be started Nov. 15.

The Independent Pneumatic Tool Co., Chicago, announces that after Nov. 1, 1922, its Cleveland office will be located at 1204-5 Citizens' Building, Cleveland, Ohio, instead of 1103 Citizens' Building.

The C. F. Davis Machine Co., Rochester, N. Y., has moved its shop to 150 N. Water Street, occupying the second story of a new building, with greatly increased floor space and capacity.

The Coburn Machine Co., San Diego, Cal., has recently moved its plant from Second and G Sts. to 853 First Street, to secure larger quarters to accommodate its growing business.

The Whiting Corporation, Harvey, Ill., manufacturer of foundry equipment, announces that the C. F. Bulotti

Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Transformer, Welding and Heating, Electric

U. S. Electric Welder Co., 327 Permanent Bldg., Cleveland, Ohio

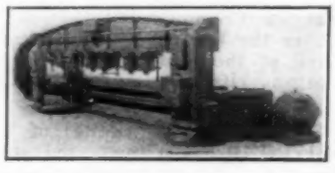
"American Machinist," September 21, 1922

The transformer is for use where hard service is encountered and high power is necessary. It is made in a variety of styles and sizes for mounting in different types of equipment. The supports for the primary and secondary coils and for the core are so placed as to prevent humming and shifting of any of the parts. The secondary is built up of heavy rolled copper bands spaced to provide ventilating ducts and well supported and insulated. The cooling surface provided is large enough to keep the temperature within safe limits during heavy overloads. The internal reactance automatically prevents the current from building up so that the temperature rises more than 50 deg. C. above the room temperature.

Planer, Plate

Niles-Bement-Pond Co., 111 Broadway, New York, N. Y.

"American Machinist," September 28, 1922

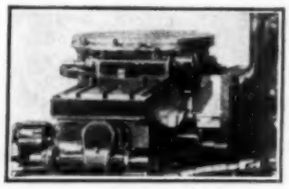


The principal features of the machine are the design of the bed and the method of attaching the carriage to the bed. Chips are thus prevented from getting on the bearing surfaces of the carriage and screw. The tool carriage is guided by square shears and is secured at both top and bottom by removable bearing supports which have taper gibs. The carriage is reversed automatically. The two swiveled relieving toolholder slides have simultaneous vertical adjustment and are mounted on a standard which has horizontal adjustment. Air is admitted into the tops of the pneumatic jacks for clamping the plate, and into the bottoms for unclamping. The direct-connected driving motor is controlled by a master switch, so that the machine may be started and stopped by a push button.

Table, Rotary, Milling Machine

Toledo Milling Machine Co., Toledo, Ohio

"American Machinist," September 28, 1922

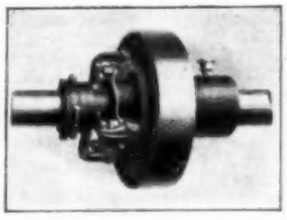


The rotary table is controlled by the regular feed levers of the machine, including the traverse. It is driven from the feed drive shaft. The sixteen regular feeds of the machine are controlled by the same lever that controls the regular feeds of the table. More than one power feed cannot be engaged at a time. The quick return is also applicable to the rotary table in either direction. The table diameter is 24 in. but work of larger diameter can be accommodated. The table is graduated throughout the entire 360 deg., and divisions to minutes can be obtained.

Clutch, Friction, Heavy-Duty, "Universal Giant"

T. B. Wood's Sons Co., Chambersburg, Pa.

"American Machinist," September 28, 1922



The disk clutch has recently been improved to adapt it to severe service encountered in the frequent starting and stopping of large machines or groups of machines. "Non-burn" friction lining is employed instead of the hard maple blocks. The clutch is made in sizes having rated capacities of from 5½ to 480 hp. at a speed of 100 r.p.m. It is of the floating disk type and may be furnished with one, two or three disks. It may be employed on lineshafts, directly on machines, or mounted in the bores of large pulleys and gears.

Lathes, Geared-Head, Heavy-Duty, 16- to 30-Inch

Cincinnati Lathe & Tool Co., Oakley, Cincinnati, Ohio

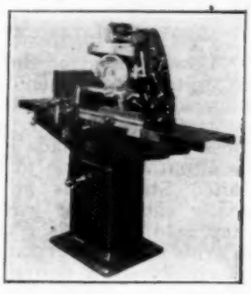
"American Machinist," September 21, 1922

The lathes are driven by belt or by motor. The 16-in. lathe will transmit 9.2 hp. with a belt pull of 65 lb. per sq. in. The direct-connected motor-driven lathes can be provided with either chain drive or belt drive using an idler pulley. The motor can be mounted on the headstock or in the rear of the cabinet leg. The control may be by means of a rod above the lathe, by a handle at the front of the head or by a lever on the apron. A disk clutch fitted with a brake disconnects the spindle from all gearing when the machine is stopped. Twelve spindle speeds can be obtained with the three handles on the front of the head. On the 16-in. lathe the range of speeds is from 13.5 to 400 r.p.m. in geometric progression.

Grinding Machine, Hob and Form Cutter, Semi-Automatic, No. 10

Harris Engineering Co., Bridgeport, Conn.

"American Machinist," September 28, 1922

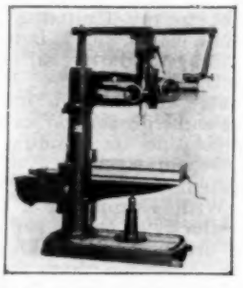


The machine is for use in shops where the number of hobs and cutters ground does not warrant the more expensive full-automatic model. The hob or cutter is carried on an arbor fitting into the work-carrying spindle. The work-holding table is operated by the hand lever at the front. Stops limit the stroke to the length of the hob. Hobs having helical flutes are rotated during the table travel by an adjustable sine bar. The spindle is driven by a belt at 2,700 r.p.m. By the truing device, teeth faces may be ground radial or with a top rake. Capacity, 8 in. in diameter and 10 in. long. Number of flutes indexed, 4 to 26. Floor space, 50 x 90 in. Weight, 1,760 pounds.

Drilling and Tapping Machine, Radial, Sensitive, High-Speed

Fosdick Machine Tool Co., Cincinnati, Ohio

"American Machinist," September 28, 1922



This drilling and tapping machine is for work that has too large an area for a high-speed sensitive upright drilling machine, and is also for small holes requiring a greater speed than can be attained on the heavy-duty model. The arm may be swung completely around the column. The sensitive feed and quick return are operated by the lever at the right or the handwheel at the left. For motor drive, a 1-hp. motor of constant or variable speed is required. The machines are built with either 3 or 3½ ft. arms. The dimensions are for the 3-ft. size. Table: vertical movement, 16 in.; working surface, 20 x 33 in.; maximum distance from spindle, 31 in. Spindles: No. 2 Morse taper; vertical traverse, 8 in.; horizontal movement, 28½ in. along the arm. Weight, 2,650 pounds.

Inclinometer, Universal

Stevens-Prentice Manufacturing Co., 377 National Ave., Milwaukee, Wis.

"American Machinist," September 28, 1922

The device is for reading and checking angles, bevels and levels. A vernier pendulum is pivoted in the center of the dial. A small brake stops the oscillation of the pendulum and holds it stationary while the reading is being taken. The device reads to 5 min., but can be furnished to read to minutes. When the line marked 0 on the vernier pendulum coincides with the line marked 0 or 90 on the scale of the dial, the instrument is plumb. The base can be fitted directly to the work that is to be measured and can be furnished with lengths of 7, 18 or 24 inches.

Clip, paste on 3 x 5-in. cards and file as desired

Machinery Co., 67 Main Street, San Francisco, Cal., has been appointed its agent for the State of California, to succeed Eccles & Smith Co., of the same city.

Personals

DR. A. C. HUMPHRIES, Stevens Institute of Technology, Hoboken, N. J., and president of the American Institute of Consulting Engineers, was the principal speaker at the fourth annual meeting of the University of Toronto Engineering Alumni Association held recently in the Canadian capital.

C. E. SKINNER, assistant director of engineering of the Westinghouse Electric & Manufacturing Company, has sailed to attend the meeting of the Rating Committee of the International Electro-Technical Commission to be held in Geneva, Switzerland, beginning November 18.

FREDERICK FRANZ, who for the past four years was chief engineer of the Terminal Engineering Co., has established an engineering office at 27 Warren St., New York City, for the purpose of solving special problems of engineering relating to labor saving machinery for industrial plants.

BENJAMIN G. LAMME, chief engineer of the Westinghouse Electric and Manufacturing Co., has been awarded the Joseph Sullivan medal by the Ohio State University in recognition of his notable engineering achievements.

Obituary

WILLIAM BLAKE WOOD, president of Gifford-Wood Co., of Hudson, New York, died October 28 at the Albany City Hospital, after a two weeks' illness. Mr. Wood was born in Arlington, Mass., July 15, 1869. He became a member of the firm of William T. Wood and Co., of Arlington, upon the death of his father in 1896 and continued as a partner with William E. Wood, and later as a member of Gifford-Wood Co. when incorporated in 1905, and succeeded Malcolm Gifford as president upon the latter's death in 1919.

O. B. FULLER, vice-president of the Enterprise Construction Co., died at his home in Los Angeles, Cal., Oct. 19, aged 57 years.

Export Opportunities

The Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., has inquiries for the agencies of machinery and machine tools. Any information desired regarding these opportunities can be secured from the above address by referring to the number following each item.

Hydraulic cotton presses for making bales weighing approximately 200 kilos and measuring 90 centimeters on each edge—Brazil. Purchase desired. Quotations, c.i.f. Brazilian port. Correspondence, Portuguese. Reference No. 4097.

Minting machinery, such as a coining press, a cutting-out machine, an edge-cutting machine, and a rolling mill, comprising in addition a breaking-down and finishing machine—Finland. Purchase desired. Quotations, c.i.f. Finnish port. Reference No. 4100.

Ice-cream-making machinery — Mexico. Purchase desired. Payment, cash. Reference No. 4101.

All machinery necessary for the establishment of a soap factory—Mexico. Purchase desired. Terms, cash against documents. Correspondence, Spanish. Reference No. 4102.

An oil-burning engine and attachments for use in a side-wheel flat-bottom scow ferry boat—Canada. Purchase desired. Quotations, f.o.b. port of shipment. Terms, cash. Reference No. 4103.

All material necessary for tin placer mining—Portugal. Purchase desired. Quotations, c.i.f. Lisbon. Terms, cash against documents. Correspondence, Portuguese or French. Reference No. 4105.

Machinery for sewing hemp soles to cloth shoes (alpargatas)—Argentina. Purchase desired. Quotations, c.i.f. Buenos Aires. Terms, cash against documents. Correspondence, Spanish. Reference No. 4106.

Representation of American firms desired, especially for the sale of goods requiring mechanical knowledge—Denmark. Reference No. 4107.

Aerial tramways for the transportation of lumber and mineral—Spain. Purchase desired. Quotations, f.o.b. New York. Reference No. 4110.

Machinery for the manufacture of pocketbooks, including sewing machines and gluing machines—Canada. Purchase desired. Reference No. 4111.

Milling machinery for small mills—Finland. Purchase desired. Quotations, c.i.f. Finnish port. Terms, cash against documents. Reference No. 4116.

Machine tools, leather belting, kerosene, spraying pumps and spraying materials and machines for orchards, plows, cultivators—Australia. Agency desired. Terms, cash against documents. Reference No. 4077.

Portable sawmill—Mexico. Agency and purchase desired. Quotations, f.o.b. factory or c.i.f. El Paso, Tex. Reference No. 4079.

Warehouse equipment, such as trolleys, hoists, packing machinery, stenciling machinery, and all such material as would be used in warehousing, motor-truck transportation, and the handling of cargo, also furniture covers—China. Purchase desired by firm in the United States having a branch agency in China. Catalogues, prices and full descriptive matter desired. Reference No. 4128.

A complete machine for grinding sugar cane, having 6 cylinders, and of a capacity for grinding 200 tons of sugar cane daily, also a steel or wooden elevator, or feeder, as well as a similar arrangement for carrying off the crushed stalks—Brazil. Purchase desired. Quotations, c.i.f. Brazilian port. Terms, cash against documents upon arrival of machinery. Correspondence, Portuguese, French or Italian. Reference No. 4140.

Machinery for the manufacture of shoe forms and heels—Italy. Purchase desired. Quotations, c.i.f. Genoa. Terms, cash against documents. Correspondence, French or Italian. Reference No. 4141.

Building hardware, trunk hardware, linoleum, etc.—Argentina. Agent is in the United States for the purpose of securing agency. Reference No. 4142.

Machinery for cannery, such as automatic press, sealing machines and automatic shears—Greece. Purchase desired. Quotations c.i.f. Greek port. Terms, payment against documents or irrevocable credit in New York. Correspondence, French. Reference No. 4143.

Steel pipes, of one-half to 6 inches—Syria. Purchase desired. Quotations, f.o.b. New York. Terms, 25 per cent cassh with order, balance against documents through bank in Tripoli. Reference No. 4144.

Wire-drawing and roller-mill machinery—Sweden. Purchase desired. Quotations c.i.f. Swedish port. Terms cash against documents. Reference No. 4145.

Machine-shop machinery, tools, and general supplies, such as lathes, planing machines, drilling machines and tools, steam hammers, foundry machinery, and cupolas for melting iron and brass—British Guiana. Purchase desired. Catalogues and prices requested. Reference No. 4147.

Machinery for the manufacture of pottery and porcelain, for drying and pulverizing clay, and for pulverizing hard rocks—Straits Settlements. Purchase desired. Quotations, c.i.f. Penang or Singapore. Catalogues are requested. Reference No. 4170.

Trade Catalogs

Logan Air Operated Chucks. The Logansport Machine Co., Logansport, Indiana. This company has just issued a new publication, known as Catalog R-15, which is a series of loose leaf bulletins, in bound form. It contains full descriptions and illustrations of the numerous types of Logan air operated chucks, labor saving devices and equipment for increasing production on automatics, turret lathes, and screw machines. Many drawings are given in the catalog showing the construction details of the different styles chucks, double acting air cylinders and other devices.

Die Heads and High Speed Tapping Devices. The Geometric Tool Co., New Haven, Conn. This company has just issued two new publications. One of them is a special booklet on the subject of its Style DS Geometric Screw cutting Die Heads, specially adapted for Browne & Sharp automatics and other single spindle machines. The publication contains a complete description of the mechanism with illustrations. The other publication is a booklet describing the company's Jarvis high speed tapping devices, tapping machines, quick change chucks and collets and self opening steel setters, with numerous illustrations.

Power Presses and Inclinable Open Back Presses. The Niagara Machine and Tool Works, Buffalo, New York. This company has just issued two new publications, on its line of presses. Bulletin 58, on its Inclinable Open Back presses is of 16 pages and describes in detail the constructive features of this line of equipment, its advantages and specifications with numerous illustrations accompanying the description. Bulletin 59 is a special four-page folder on the Niagara power press, containing a complete description with specifications and illustrations.

Pyrometers. The Brown Instrument Co., Philadelphia, Pa. "What's Under the Hood of Brown Pyrometers" is the title of a new bulletin just issued by this company. The publication has for its object a clearer understanding of the material and mechanism which goes into the company's product, how the product is designed and the method employed in putting it together.

Forthcoming Meetings

American Marine Association, Convention and Exhibition, Grand Central Palace, Nov. 3 to 11.

National Personnel Association, First Annual Convention, November 8, 9 and 10, at Pittsburgh, Pa. Secretary at 20 Vesey St., New York, N. Y.

Automotive Equipment Association. Annual show and meeting, November 13 to 18, Chicago, Ill.

National Founders' Association, Nov. 22 and 23. Secretary, J. M. Taylor, 29 South LaSalle St., Chicago Ill.

Eighteenth Annual Automobile Salon, Commodore Hotel, New York City, December 3 to 9, 1922.

American Society of Mechanical Engineers, annual convention, December 4 to 7, 1922, New York City. Secretary, Calvin W. Rice, 29 West 39th Street, New York City.

National Exposition of Power and Mechanical Engineering. Dec. 7 to 13, 1922, Grand Central Palace, New York City. Secretary, Calvin W. Rice, 29 West 39th Street, New York City.

National Automobile Chamber of Commerce, National Automobile Show, Grand Central Palace, New York City, January 6 to 13, 1923.

National Automobile Chamber of Commerce, National Automobile Show, January 27 to February 3, 1923, Coliseum and First Regiment Armory, Chicago, Ill.

American Engineering Council, Annual Meeting, January 11 and 12, at the headquarters of F. A. E. S., 24 Jackson Place, Washington, D. C. L. W. Wallace, Secretary.

American Institute of Electrical Engineers, Mid-Winter Meeting, February 14 to 16. Engineering Societies Bldg., New York. F. L. Hutchinson, Secretary.

American Institute of Mining and Metallurgical Engineers, Annual Meeting, February 19 to 21. Engineering Societies Bldg., New York. F. S. Shartless, Secretary.

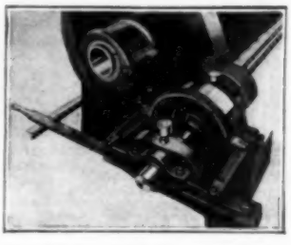
Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Glue Pot, Bench, Electric
J. D. Wallace & Co., 1401 W. Jackson Blvd., Chicago, Ill.
"American Machinist," September 14, 1922

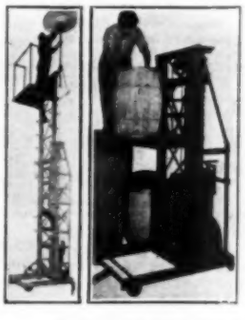
The temperature of this electrically heated glue pot is controlled automatically and the current may be taken from an electric lighting circuit. The temperature rises and is maintained between 140 and 150 deg. F. The glue is always kept at the proper temperature for use, although it is not cooked sufficiently to injure its holding properties. The pot may be employed either as a water bath, or as a hot air or a dry heat pot. The thermostat contains a sensitive volatile substance that contracts and expands with changes in temperature, so as to operate the control switch when the temperature rises to the upper limit or falls to the lower limit. The dial gage indicates the temperature.

Clutch and Brake, Combination, for Tumbling Barrels
Whiting Corporation, Harvey, Ill.
"American Machinist," September 14, 1922



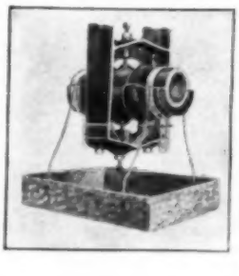
The mechanism is for use in starting and stopping tumbling barrels and mills. It is simple in construction and is controlled by a single hand lever. Shifting the lever toward the mill engages the clutch and starts the barrel rotating. To stop the barrel, the lever is moved in the reverse direction, passing through the neutral position and to the braking position. The clutch permits of stopping a loaded mill at exactly the point desired for unloading. The barrel is held in position while the unloading is taking place. Even though the barrel is unevenly loaded, it cannot turn when the brake is set.

Tiering Machine, Telescoping, Portable, "Economy"
Economy Engineering Co., 2635 West Van Buren St., Chicago, Ill.
"American Machinist," September 21, 1922



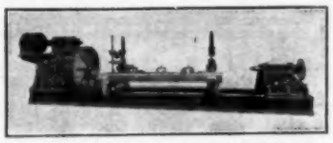
In this machine one frame member telescopes into another so that the machine has a lift nearly twice as high as its minimum height. It is made in both hand power and electric driven styles. The heavy-duty types of the latter style are operated from a power circuit, and the "Little Lifter" types from a lighting circuit. The machine is ordinarily mounted on three rollers, and when positioned for lifting the steering roller is raised so that the legs rest on the floor and prevent the machine from moving. Outriggers are provided for tall machines to support them at the sides.

Pan, Drip, Oil, Lineshaft
The Akron Sheet Metal Co., 103 No. Main St., Akron, Ohio
"American Machinist," September 21, 1922



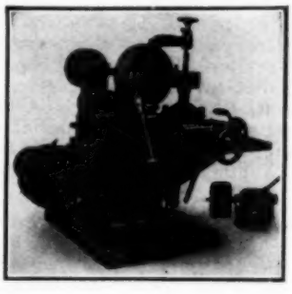
The drip pan and hanger are for catching the oil that drops from bearing boxes. It is especially intended for use on overhead lineshafts, but can be adapted to bearings secured to wall or post brackets. The pans and hangers are made in three sizes, each size being suitable for a range of shaft sizes. Shafts from 1¼ to 2¼ in. in diameter can be fitted. The hangers can be quickly installed on any style of bearing box. The pan may be easily removed for cleaning without disturbing the hangers. Sizes, 6 x 8 in., 8 x 10 in., 10 x 12 in.; 2 in. deep.

Lathe, Roll, 42-Inch
Reading Iron Co., Scott Foundry Dept., Reading, Pa.
"American Machinist," September 14, 1922



The machine has a capacity for turning a chilled roll 42 in. in diameter by 120 in. long. It is driven by a 20-hp. variable-speed motor, the speeds of which range from 400 to 600 r.p.m. The gear box has two changes of speed, arranged so that the full range of motor speed can be employed with each. The face-plate speed varies from 0.4 to 1.6 r.p.m. The main spindle is 7¾ in. in diameter, and the gears are machine cut. The bearings are large. The heavy construction provides the strength required for heavy service. Weight, 35,000 pounds.

Grinding Machine, Pulley
Diamond Machine Co., Providence, R. I.
"American Machinist," September 21, 1922



The machine is for grinding the faces and edges of pulleys and similar parts. It carries a 14-in. diameter cylinder wheel held in a steel chuck that insures against wheel breakage. The wheel spindle, running on ball bearings, is driven by a 10-hp. motor at about 1,500 r.p.m., the speed being varied to suit the work. The work table has screw-operated movement in three planes, and an auxiliary rapid movement to and from the wheel actuated by a hand lever. Pulleys may be ground with crown, flat, or concave faces. Capacity: pulleys of 2 to 18-in. diameter, up to 6-in. face. Floor space, 3 ft. 6 in. by 4 ft. 6 in. Weight, 2,000 pounds.

Wrench, End, Adjustable, "Instant-Positive"
Gellman Wrench Corp., 131 W. Washington St., Chicago, Ill.
"American Machinist," September 21, 1922

The end wrench can be adjusted instantly and stays adjusted until the nut is loosened or tightened. It is strong, but light in weight and thin enough to work in cramped places. No screw is employed in the wrench. The handle member forms the lower jaw and is notched at right angles to the gripping face, while the movable upper jaw is also notched and can be moved up or down when the notches are pulled out of engagement. The wrench can be turned in either direction. The tool is manufactured in sizes of 6-, 9- and 12-in. The 6-in. wrench is suited for light work. The 9- and 12-in. are for heavy duty but fit small nuts as well as large ones. Weight, 4, 10 and 20 ounces.

Key, Machine, Self-Fitting, "Keytite"
Smith & Serrell, Central Ave., at Halsey St., Newark, N. J.
"American Machinist," September 21, 1922

The key is capable of making its own fit in the keyway by shaving the sides of the keyway as it is put in place. It is ground to a size very slightly larger than the nominal width. A cutting edge and chip recess are provided near the front end of the key and a pilot, slightly smaller than the nominal keyway width, fits the keyway and guides the key. In the larger sizes, cutting edges are sometimes provided on both sides. For fitting the top and the bottom as well as the sides, a cutting edge can be provided at the top. Gib keys and other modifications of keys can be furnished with the self-fitting feature. The keys can be furnished in a wide range of sizes, as to both width and length.

Clip, paste on 3 x 5-in. cards and file as desired

New and Enlarged Shops

Machine Tools Wanted

Calif., Vallejo—The city, T. D. Kilkenny, City Engr.—$1,000 worth of machinery for proposed garage and repair shop on Virginia St.

Ill., Anna — A. Hargrave (machinist) — short engine lathe, 20 to 28 in. swing.

Ia., Fairfield—Louden Mchy. Co.—One No. 32 Kempsmith milling machine (used).

Kan., Wichita—E. L. Bryan, 622 Pattie Ave., (garage)—drill press, belting, hangers, emery wheel and stand for power equipment (used).

Kan., Wichita — O. G. Smith Machine Shop, 132 North Lawrence Ave.—milling machine and drill press for power equipment (used).

Kan., Wichita—Universal Repairing Co., 122 East 2nd St., (cabinet worker)—A. Travis, Purch. Agt.—wood lathe for power attachment (used).

Kan., Wichita — W. J. Williams, 1103 Lulu Ave., (machinist) — power lathe (used).

Mass., Cambridge—D. E. Forsyth, 14 Parker St.—machinery and equipment for proposed garage at 17 Coventry St.

Mass., Winthrop—Winthrop Motor Sales Co., Somerset Ave.—machinery and equipment for proposed garage.

Mich., Muskegon Heights—The Maxim Motor Co., C. Branston, Purch. Agt.—lathes, drill press, also screw and milling machinery for proposed factory.

Mo., Kansas City—Flexibuilt Belt Mfg. Co., 4404 East 15th St.—pipe threading and cutting machine.

Mo., St. Louis — Mid-Continent Equipment & Mchy. Co., Security Bldg., C. G. Davis, Purch. Agt.—stamping press.

N. Y., Buffalo—J. Waechler, Ross and Ontario Sts.—machinery, tools and equipment for garage and service station.

N. Y., Long Island City—A. Kimoney, 276 Jackson Ave. (builder)—small electric portable riveter.

N. Y., New York—J. E. Kahn, 224 West 20th St. (plumbing)—sheet metal working tools, including brake, etc.

O., Columbus—Brightman Bros. Co., 531 Linwood Ave., (manufacturer of shafting, etc.), G. F. Brightman, Purch. Agt.—screw making machinery, lathes, grinders, presses, etc.

O., Columbus—Fairfield Eng. Co., West 6th St., along tracks of Hocking Valley Ry.—lathes, drill press, grinder, etc.

Ore., Portland—The city, L. D. Kaiser, City Hall, Supt. of Water Works—$1,350 worth of hand tools and one tapping machine.

Pa., Phila.—Pennsylvania R.R., 17th and Filbert St., M. Smith, Purch. Agt.—one 90 in. tire mill, one 6 and one 4 spindle bolt turning machines, 3 turret lathes, ten 4 x 36 in. emery grinders, two 15 in. and three 18 in. slotters, three No. 5 knee type milling machines, 17 engine lathes, six 36 and three 48 in. vertical turret lathes, two 36 in. planers and two 90 in. drive wheel lathes, for shops at Altoona

Pa., Phila — Sobel Machine Co., 880 North 48th St., (machinists), A. Sobel, Purch. Agt.—16 in. shaper (used preferred).

Pa., Sharon—R. Deflin—Complete equipment for proposed welding and machine shop on River Ave.

W. Va., Wheeling—Hazel Atlas Glass Co. —machine shop equipment for branch plant at Washington, Pa.

Wis., Green Bay—J. Strathas, 315 Cass St. (garage)—repair machinery, small tools and air compressor.

Wis., LaCrosse — Bergh Auto Co., 207 South 4th St.—auto repair machinery, including drill press and small tools.

Wis., Madison—West End Auto Repair Co., c/o J. B. Sanborn, 16 North Carroll St.—repair machinery and chain hoist.

Wis., Milwaukee—Wisconsin Sheet Metal & Furnace Wks., 2928 Lisbon Ave., A. Blecker, Purch. Agt.—punch press to punch ½ in. hole, with cutting attachment, also one large size beader.

Wis., Milwaukee — Wisconsin Steel & Dock Co., 253 3rd St., (structural steel and marine repairs), F. W. Stevens, Purch. Agt.—punch presses, power shears, pneumatic tools and air compressor.

Que., Levis—Levis County Ry., E. E. Weyman, Mgr.—32 in. lathe, screw jack car hoist, shaper, vertical drill, double end emery grinder, combination circular saw, planer and band saw and small lathe.

Machinery Wanted

Ark., Conway—Conway Weekly News—linotype and other printing equipment.

Calif., San Diego—Kirk, Roche & Co., 338 7th St.—sheet metal work machinery, also catalogues and prices of machinery for the manufacture of restaurant equipment, furnaces, heating and ventilating equipment, skylights and cornices.

D. C., Wash.—U. S. Chief Engineer—one locomotive crane.

Fla., Daytona Beach—Peninsular Ice & Cold Storage Co., G. G. Bailey, Pres.—cold storage and ice manufacturing machinery and equipment for proposed $100,000 plant here.

Ill., Chicago—Kraft Bros. Cheese Co., 402 Rush St.—special cheese making machinery, belting and shafting, for branch at Antigo, Wis.

Ill., Chicago—W. S. Swift, Brevoort Hotel, 120 West Madison St. (machinist)—emery stand and wheel, sand blast, jig saw for power attachment.

Ind., Hammond—Wanner Malleable Iron Wks.—power hammer.

Ind., Lafayette — The National Refining Co., Kossuth St.—machinery and equipment for proposed oil refinery to replace that which was recently destroyed by fire.

Kan., Wichita—Bd. Educ., C. P. Mueller, Pres., 145 North Main St.—tenon power saw for manual training department of public school.

Kan., Wichita—J. Robertson, 1435 Pattie Ave.—complete set boiler maker's tools and welding outfit for welding boilers.

Ky., Bargourville—Cumberland & Manchester R.R. Co., C. F. Heidrick, Purch. Agt.—equipment for proposed forge shop.

Ky., Montago—Means-Haskins Coal Co.—coal tipple machinery and equipment, including handling and conveying equipment.

La., La Fayette—The La Fayette Sugar Refining Co.—machinery and equipment for proposed refinery, to replace that which was recently destroyed by fire.

Mich., Detroit—J. C. Green, 3656 Seminole Ave.—band saw, wood turning lathe, rip saw, buzz planer and thickness planer.

Minn., Minneapolis — Century Laundry Mchy. Corp., 426 Lincoln St., N. E., J. T. Marrin, Purch. Agt.—machinery and equipment for the manufacture of laundry machinery.

Mo., Carthage—Carthage Casket Co., c/o E. Ulmer Undertaking Co.—wood working machinery.

Mo., St. Louis—C. L. Holland, 909 North 15th St.—power job printing press and power paper cutter.

Mo., St. Louis—Modern Printing Co., 2604 Olive St.—12 x 18 in. Chandler & Price press (used preferred).

N. Y., Buffalo—DuPont Fibre Silk Co., River Rd.—machinery and equipment to double present capacity of plant.

N. Y., Buffalo—C. Grant, 75 Eagle St.—printing machinery for plant at 77 East Eagle St.

N. Y., Buffalo—C. Sudrow, 633 Bway.—machinery for the manufacture of wooden bodies for cars and trucks, for plant at 1099 Genesee St.

N. Y., Buffalo—U. S. Radiator Wks., 1285 Main St., W. H. Smith, Purch. Agt.—equipment for repairing automobile radiators, fenders and bodies, for plant at 16-18 Glenwood Ave.

N. Y., Chili (Lincoln Park P. O.)—J. Harris Seed Co. (seed distributors and sorters)—machinery and equipment for proposed addition to seed plant.

N. Y., Fairport—Douglas Packing Co.—complete machinery and equipment for proposed addition to packing plant.

N. Y., Fredonia — Grape Ola Products Corp., (manufacturer of grape products), H. Card, 123 Cushing St., Dir.—machinery and equipment for proposed addition to plant.

N. Y., Jamestown—Jamestown Panel Co., 34 Steele St.—machinery and equipment for two story addition to panel and furniture factory.

N. Y., New York—Bd. Educ., Park Ave. and 59th St.—P. Jones, Supt. of School Supplies—receiving bids until Nov. 10th for work shop supplies for the day and evening, high and elementary schools.

N. Y., New York—New York Central R.R., Purchasing Dept., 466 Lexington Ave.—one 90,000 lb. power press brake, motor driven.

N. Y., Olean—Olean Garment Mfg. Co., 430 North Union St., E. I. Lovitz, Mgr.—machinery and equipment for garment factory.

N. Y., Rochester — Rochester Packing Co., 900 Maple St.—machinery and equipment for cold storage plant, and for the manufacture of sausage.

N. Y., Tonawanda—The National Roofing Co., Fillmore St.—complete machinery and equipment for proposed branch factory at Athens, Ga.

O., Akron—Enterprise Mfg. Co., 217 Ash St. (manufacturer of small brass, nickel and steel parts)—sand blasting equipment.

O., Cleveland—The Upco Co., 4805 Lexington Ave.—steam jacketed kettles, about 50 gal. capacity.

O., Cleveland—The Wilkshire-Wilk Co., 2162 East 2nd St.—annealing gas furnace with blower (used).

O., Columbus—Dept. of Finance of Ohio, State House, R. V. Johnson, Supt. Division Purchase—one 40 x 94 in. reverse drying tumbler, one No. 38, one No. 51 and two 42 x 84 in. Universal presses, one 48 in. over driven type extractor and other laundry equipment, for the Institution for Feeble Minded.

O., Columbus—Western Newspaper Union —job printing press and paper cutter for power equipment.

O., Lima—Buckeye Casting Co.—equipment for new $75,000 foundry.

O., Ottawa—Putnam Mfg. Co., (manufacturer of wooden articles), G. W. Kahle, Mgr.—complete woodworking equipment for factory.

O., Springfield — Robbins-Meyers Co., Shuey Bldg. (manufacturer of electric motors, fans, etc.)—machinery and equipment for proposed additions to factory.

O., Urbana—Gaumer Publishing Co., (job printers)—No. 5 linotype machine (used).

O., Warren—The Wadsworth Feed Co., J. X. Wadsworth, Pres.—$20,000 worth of machinery for proposed flour mill to replace that which was destroyed by fire.

Pa., Bridgeville—Universal Steel Co.—one 10 ton crane.

Pa., Corry—The Corry-Jamestown Furniture Co.—machinery and equipment for proposed addition to furniture factory.

Pa., Darby—Darby Print Shop, 232 Mall St.—one 10 x 15 in. press, type stands, type, etc.

Pa., Edwardsville (Kingston P. O.) — Wyoming Valley Bakery, R. H. Levy, 388 Chestnut St., Kingston, Dir.—equipment for new bakery.

Pa., Erie — The Dispatch-Herald, 12th and French Sts.—linotype machines and other printing equipment.

The Weekly Price Guide

RISE AND FALL OF THE MARKET

Advances—Lead quoted in New York warehouses at 7⅛c. as against 6.95c., a rise of $10 per ton in two days; zinc, now 7⅛c. as compared with 7¼c. per lb., one week ago. Tin also advanced 1c., making the present warehouse price 38c. per lb. Zinc sheets up ¼c. per lb. in casks. Both white and red lead, dry and in oil, advanced ¼c. per lb. f.o.b. New York.

Declines—Steel plates quoted at maximum of $2 per 100 lb., f.o.b. Pittsburgh, on sizeable tonnages. Shapes quoted as low as $1.90 on attractive business and at a maximum of $2.10 where orders involve special considerations and speed in shipments, consistent with present embargoes, but average remains at $2 per 100 lb., f.o.b. mill. Market soft on bars with few new inquiries. Some orders booked at $1.90 but average price $2. Sales, however, of carload lots for early delivery quoted at $2.10 per 100 lb.

IRON AND STEEL

PIG IRON—Per gross ton—Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$31.55
Northern Basic	33.27
Southern Ohio No. 2	33.27
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	35.80
BIRMINGHAM	
No. 2 Foundry	27.50
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	32.64
Virginia No. 2	37.17
Basic	31.75
Grey Forge	30.50
CHICAGO	
No. 2 Foundry local	32.00
No. 2 Foundry, Southern (silicon 2.25@2.75)	33.50
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	31.77
Basic	31.77
Bessemer	33.77

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	6.0
New York	5.5
Chicago	4@5
Cleveland	2.4

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York	Cleveland	Chicago
No. 10	2.50@2.85	4.19	3.70	4.00
No. 12	2.60@2.95	4.24	3.75	4.05
No. 14	2.70@3.00	4.29	3.80	4.10
No. 16	2.90@3.30	4.39	3.90	4.20
Black				
Nos. 17 and 21.	3.20@3.60	4.70	4.20	4.70
Nos. 22 and 24.	3.25@3.65	4.75	4.25	4.70
Nos. 25 and 26.	3.30@3.70	4.80	4.30	4.75
No. 28	3.35@3.75	4.90	4.40	4.85
Galvanized				
Nos. 10 and 11.	3.35@3.85	4.90	4.40	4.85
Nos. 12 and 14.	3.45@3.95	5.00	4.50	4.95
Nos. 17 and 21.	3.75@4.25	5.30	4.80	....
Nos. 22 and 24.	3.90@4.40	5.45	4.95	5.40
No. 26	4.05@4.55	5.60	5.10	5.55
No. 28	4.35@4.85	5.90	5.40	5.95

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the latest Pittsburgh basing card:

Steel Inches	Black	Galv.	Inches	Iron Black	Galv.
			BUTT WELD		
1 to 3	66	54½	⅜ to 1½	34	19
			LAP WELD		
2	59	47½	2	29	15
2½ to 6	63	51½	2½ to 4	32½	19
7 to 8	60	47½	4½ to 6	32½	19
9 to 12	59	46½	7 to 12	30	17
			BUTT WELD, EXTRA STRONG, PLAIN ENDS		
1 to 1½	64	53½	⅜ to 1½	34	20
2 to 3	65	54½			
			LAP WELD, EXTRA STRONG, PLAIN ENDS		
2	57	46½	2	30	17
2½ to 4	61	50½	2½ to 4	33	21
4½ to 6	60	49½	4½ to 6	32	20
7 to 8	56	43½	7 to 8	25	13
9 to 12	50	37½	9 to 12	20	8

Malleable fittings. Classes B and C, Banded, from New York stock sell at net list. Cast iron, standard sizes, 20–5% off.

WROUGHT PIPE—Warehouse discounts as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded.	57%	44%	55½%	43½%	62½%	48½%
2½ to 6 in. steel lap welded.	54%	41%	53½%	40½%	59½%	45½%

Malleable fittings. Classes B and C, Banded, from New York stock sell at list less 6%. Cast iron, standard sizes, 32% off.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.50	6.00	4.50
Spring steel (light) (base)	6.00	6.00	6.00
Coppered Bessemer rods (base)	6.03	8.00	6.10
Hoop steel	4.39	3.71	3.90
Cold rolled strip steel	6.75	8.25	7.25
Floor plates	5.50	5.16	5.50
Cold finished shafting or screw	3.90	3.75	3.70
Cold finished flats, squares	4.40	4.25	4.20
Structural shapes (base)	3.14	3.01	3.02½
Soft steel bars (base)	3.04	2.91	2.92½
Soft steel bar shapes (base)	3.04	2.91	2.92½
Soft steel bands (base)	3.84	3.61	3.55
Tank plates (base)	3.14	3.01	3.02½
Bar iron (2.60 at mill)	3.04	2.91	2.82½
Drill rod (from list)	55@60%	40%	50%
Electric welding wire:			
5/32	8.00		12@13
¼	6.50		11@12
5/32 to ¼	6.25		10@11

METALS

Current Prices in Cents Per Pound

	New York	Cleveland	Chicago
Copper, electrolytic (up to carlots), New York	14.50		
Tin, 5-ton lots, New York	38.00		
Lead (up to carlots), St. Louis 6.80; New York	7.37½		
Zinc (up to carlots), St. Louis 7.10@7.15; New York	7.62½		
Aluminum, 98 to 99% ingots, 1-15 ton lots	20.70	23.00	20.00
Antimony (Chinese), ton spot	7.25@7.37½	8.50	8.00
Copper sheets, base	21.50	22.00	23.00
Copper wire (carlots)	16.00	18.00	16.25
Copper bars (ton lots)	20.00	23.00	19.50
Copper tubing (100-lb. lots)	24.75	25.00	23.00
Brass sheets (100-lb. lots)	18.50	20.75	18.75
Brass tubing (100-lb. lots)	23.00	24.00	20.50

—Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Brass rods (1,000-lb. lots)	17.00	18.75	15.75
Brass wire (carlots)	19.00	20.75	.....
Zinc sheets (casks)	10.00	10.25	.....
Solder (½ and ½), (caselots)	26.50	23.50	20.00
Babbitt metal (83% tin)	35.00	45.00	36.00
Babbitt metal (35% tin)	25.00	17.25	.....
Nickel (ingot and shot), Bayonne, N. J.	36.00	.....	.....
Nickel (electrolytic), Bayonne, N. J .	39.00	.....	.....

SPECIAL NICKEL AND ALLOYS—Price in cents per lb.

Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	50
Cold drawn rods, Grades "A" and "C" (base)	60
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled (base) rods "D"—low manganese	54
Manganese nickel hot rolled (base) rods "D"—high manganese	57

Base price of monel metal in cents per lb., f.o.b. Bayonne, N. J.:

Shot	32.00	Hot rolled machined rods (base)	48.00
Blocks	32.00	Hot rolled rods (base)	40.00
Ingots	38.00	Cold drawn rods (base)	50.00
Sheet bars	40.00	Hot rolled sheets (base)	45.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	12.00	12.75	12.00
Copper, heavy, and wire	11.75	12.25	11.50
Copper, light, and bottoms	9.75	10.25	10.50
Lead, heavy	4.75	5.25	4.75
Lead, tea	4.25	4.25	4.00
Brass, heavy	7.00	6.50	9.25
Brass, light	6.00	5.75	6.00
No. 1 yellow brass turnings	6.50	7.00	7.00
Zinc	3.00	4.00	4.25

TIN PLATES—American Charcoal Plates—Bright—Cents per lb.

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	20x28, 112 sheets	20.00	18.25	18.50
IX,	20x28, 112 sheets	23.00	21.00	20.90
"A" Grade:				
IC,	20x28, 112 sheets	17.00	16.00	17.00
IX,	20x28, 112 sheets	20.00	18.75	19.60
Coke Plates, Bright				
Prime, 20x28 in.:				
100-lb.,	112 sheets	12.50	11.00	14.50
IC,	112 sheets	12.80	11.40	14.80
Terne Plate				
Small lots, 8-lb. Coating:				
100-lb.,	14x20	7.00	6.00	7.25
IC,	14x20	7.25	6.25	7.40

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.09@$0.11½	$0.12	$0.11½
Cotton waste, mixed, per b.	.065@.10	.09	.08
Wiping cloths, 13½x13½, per lb.	.16	32.00 per M	.10
Wiping cloths, 13½x20½, per lb.	.20	48.00 per M	.13
Sal soda, 100 lb. lots	2.80	2.40	2.65
Roll sulphur, per 100 lb	2.85	3.25	3.50
Linseed oil, per gal., 5 bbl. lots	.93	1.01	.94
White lead, dry or in oil	100 lb. kegs.	New York,	13.25
Red lead, dry	100 lb. kegs.	New York,	13.25
Red lead, in oil	100 lb. kegs.	New York,	14.75
Fire clay, per 100 lb. bag		.80	1.00
Coke, prompt furnace, Connellsville	per net ton	$8.00	
Coke, prompt foundry, Connellsville	per net ton	10.50@12.50	

SHOP SUPPLIES

Current Discounts from Standard Lists

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in	40%	50-10-5%	50%
1½ and 1¼x3 in. up to 12 in	20%	50%	50%
With cold punched sq. nuts	25%	$3.50 net	....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	30%	3.50 net	$4.00 off
Button head bolts, with hex. nuts	15%	3.90 net	.....
Hex. head and hex. nut bolts	20%	.....	65-5%
Lag screws, coach screws	40%	.....	60-5%
Square and hex. head cap screws	70%	70%	70-10%
Carriage bolts, up to 1 in. x 30 in	30%	40-10%	45%
Bolt ends, with hot pressed nuts	40%	.....	55%
Tap bolts, hex. head, list plus	20%	.....	.....
Semi-finished nuts ⅝ and larger	60%	70%	80%
Case-hardened nuts	50%	.....	.....
Washers, cast iron, ½ in., per 100 lb. (net)	$6.00	$3.50	$3.50
Washers, cast iron, ⅜ in. per 100 lb. (net)	4.50	4.00	3.50
Washers, round plate, per 100 lb. Off list	3.00	5.00	3.50 net
Nuts, hot pressed, sq., per 100 lb. Off list	1.00	3.00	4.00
Nuts, hot pressed, hex., per 100 lb. Off list	1.00	3.00	4.00
Nuts, cold punched, sq., per 100 lb. Off list	1.00	3.00	4.00
Nuts, cold punched, hex., per 100 lb. Off list	1.00	3.00	4.00
Rivets:			
Rivets, 7/16 in. dia. and smaller	45%	60%	60%
Rivets, tinned	50%	60%	4½c. net
Button heads ¾-in., ⅞-in., 1x2 in. to 5 in., per 100 lb. (net)	$5.00	$3.90	$3.75
Cone heads, ditto (net)	5.10	4.00	3.85
1½ to 1¾-in. long, all diameters, *EXTRA* per 100 lb	0.25	.....	0.15
⅝ in. diameter *EXTRA*	0.15	.....	0.15
½ in. diameter *EXTRA*	0.50	.....	0.50
1 in. long, and shorter *EXTRA*	0.50	.....	0.50
Longer than 5 in. *EXTRA*	0.25	.....	0.25
Less than 200 lb *EXTRA*	0.50	.....	0.50
Countersunk heads *EXTRA*	0.35	.....	$3.70 base
Copper rivets	55-5%	50%	50%
Copper burs	35%	50%	20%

Lard cutting oil (50 gal. bbl.) per gal.	$0.55	$0.50	$0.67½
Machine lubricant, medium-bodied (50 gal. bbl.), per gal.	0.33	0.35	0.40
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, New York, per ply, 12-in. wide, per lin.ft., $2.88:			
Medium grade	40-5%	40½%	50%
Heavy grade	30-5%	30-5%	40-5%
Rubber and duck:			
First grade	60-5%	50-10%	40-10%
Second grade	65-10%	60-5%	60-5%
Abrasive materials—In sheets 9x11 in.:			
No. 1 grade, per ream of 480 sheets,			
Flint paper	$5.84	$5.84	$6.48
Emery paper	8.80	11.00	8.80
Emery cloth	27.84	31.12	29.48
Flint cloth, regular weight, width 3½ in., No. 1 grade, per 50 yd. roll,	4.50	4.28	4.95
Emery discs, 6 in. dia., No. 1 grade, per 100.			
Paper	1.32	1.24	1.40
Cloth	3.02	2.67	3.20

Pa., Huntingdon—Extension Radiator Wks.—foundry equipment to replace that which was recently destroyed by fire.

Pa., Lebanon—R. Boyer—machinery for the manufacture of special automobile hingrim.

Pa., Phila.—Majestic Silk Dyeing Co., 3rd and Bristol Sts.—winders, dyeing vats, accessories and drying frames.

Pa., Pittsburgh—Guibert Steel Co., 703 Diamond Bk. Bldg.—joiners, woodworking machinery, compressors and band saws.

Pa., Pittsburgh — Pennsylvania R.R., Union Sta., W. G. Phelps, Purch. Agt.—two cranes for Conway shops at Freedom.

Pa., Sheffield—Sheffield Glass Bottle Co.—machinery and equipment for large addition to glass bottle works.

Pa., Tamaqua — Tamaqua Mfg. Wks. (manufacturer of mining machinery)—machinery and equipment for proposed addition to plant.

Pa., Warren—Bd. Educ., c/o J. G. Smith, member Bldg. Com.—vocational equipment for proposed $400,000 junior high school.

R. I., Woonsocket—The Manchester Co., (manufacturer of cotton and woolen goods)—looms and other machinery for mill at North Oxford, Mass.

S. D., Edgemont—The Printer, Box 567—complete newspaper equipment, including press, job press, linotype, hangers, pulleys, belting and bearings.

Tenn., Dyersburg — Churchill Compress Co. — complete machinery and equipment for proposed cotton compress plant.

Tenn., Morristown — Taylor Mfg. Co., (woodworking plant), W. H. Taylor, Pres.—band saw, jointer, planer, line shaft, pulleys and several electric motors.

Tex., Athens—Citizens Ice Co., F. N. Drake, Dir.—machinery and equipment for ice manufacturing plant, to replace that which was destroyed by fire.

Wis., Beloit—F. R. Fiebke & Co., 751 5th St. (general contractors)—woodworking machinery for new shop.

Wis., Beloit—Perrigo Fdry. and Machine Co., 8 Emerson St., W. S. Perrigo, Purch. Agt.—foundry equipment.

Wis., Boscobel—National Wood Products Co., c/o J. M. Reppen—woodworking machinery.

Wis., Cedar Grove—Cedar Grove Shoe Mfg. Co., M. J. De Master, Purch. Agt.—shoe working machinery.

Wis., Fort Atkinson—Better Sox Knitting Co., 211 South Water St., D. Becker, Mgr.—power and special machinery for proposed factory.

Wis., Green Bay—A. F. Coffrin, South State St. (paper manufacturer)—belt driven conveying machinery.

Wis., Madison—W. D. Bird, Pioneer Bldg. (jobber)—complete newspaper plant, including printing press, linotype, belting, hangers, pulleys and motor shafting (used).

Wis., Milton—Burdick Cabinet Co., F. A. Anderson, Purch. Agt.—nickel plating machinery and equipment.

Wis., Milwaukee—C. Daniel, 1741 Teutonia Ave. (carpentry and millwork)—cut-off saw.

Wis., Milwaukee—A. G. Faehnel, 748 New York Ave. (carpentry and mill work) — joiner and rip saw.

Wis., Milwaukee—Kath Monument Co., c/o J. G. Jansen, 1223 38th St., (monuments)—stone cutting machinery.

Wis., Milwaukee—S. Kosecki, 1479 Fratney St. (carpentry and millwork)—one electrically operated floor surfacing machine.

Wis., Milwaukee—R. E. Oberst, Archt., 307 Grand Ave. (owner's name withheld)—gasoline storage tank and pump for proposed $40,000 garage on 16th St. and Fond du Lac Ave.

Wis., Milwaukee—A. Sandrock Co., 1217 4th St. (structural steel), W. A. Sandrock, Purch. Agt.—power saw.

Wis., South Milwaukee—A. E. Koerner (newspaper and job work)—paper cutter, printing press, belting, shafting, linotype, pulleys, hangers for power equipment (used).

Wis., South Milwaukee—South Milwaukee Brick Co., 706 Hawthorne Ave., E. C. Guhr, Purch. Agt.—motor driven mixing machine and crusher.

Wis., Walworth—Walworth Condensed Milk Co., refrigeration machinery for proposed addition to condensery.

B. C., Nordin—The J. Buckley Estate—machinery for proposed sawmill to replace that which was destroyed by fire.

B. C., Vancouver—Standard Shingle Co., Ltd.—machinery and equipment for proposed shingle mill.

N. B., Bathurst — Bathurst Co. — additional equipment for sulphate pulp mill to increase capacity from 15,000 to 19,500 ton.

Metal Working Shops

Calif., Emeryville—The Great Western Meter Co., 5701 South San Pablo Ave., Piedmont, has had plans prepared for the construction of a 1 and 2 story factory, here. Estimated cost $30,000. G. Rushforth, 354 Pine St., San Francisco, Archt.

Calif., Fresno—The Lisenby Mfg. Co., Kern and Angus St., awarded the contract for the construction of a factory for the manufacture of multicolor presses. Estimated cost $10,000.

Calif., Sacramento—The Latourette-Fical Co., 907 Front St., plumbing and heating contractors, will soon award the contract for the construction of a 3 story workshop. Cost between $17,000 and $19,000.

Calif., San Francisco—J. Cassaretto, 347 Berry St., has had plans prepared for the construction of a 1 story, 90 x 125 ft. machine shop on N.W. Folsom and Dore Sts. Estimated cost $25,000. M. Sheldon, 110 Sutter St., Archt.

Calif., San Francisco—E. L. Reese, 332 Pine St., awarded the contract for the construction of a 1 story factory on Bryant St. near Morris St. Estimated cost $6,000. Gorman Metal Co., 141 Clara St., manufacturer of babbitt steel, lessee.

Calif., Vallejo—The city has had plans prepared for the construction of a 50 x 130 ft. garage and repair shop on Virginia St. Estimated cost $4,000. T. D. Kilkenny, City Engr.

Calif., Watsonville—Watsonville Union High School Dist. will soon award the contract for the construction of a 1 story machine shop. T. S. MacQuiddy, Clk. Noted Oct. 12.

Ia., Dubuque—Bosky's Motor Co., 6th and Iowa Sts., is having plans prepared for the construction of a 3 story, 100 x 110 ft. garage. Estimated cost $60,000. Private plans.

Md., Baltimore—The American Can Co., 120 Bway., New York City, plans to build a factory on Boston and Hudson Sts., here. Estimated cost $350,000.

Mass., Chicopee—The Moore Drop Forging Co., 38 Walter St., Springfield, awarded the contract for converting office building into laboratory, and for the construction of a 1 story, 40 x 90 ft. machine shop, on Depot St., here. Estimated cost $25,000. A. L. Converse, Purch. Agt.

Mass., Pittsfield—The General Electric Co., River Rd., Schenectady, awarded the contract for the construction of a 1 story, 100 x 516 ft. factory, here. Estimated cost $150,000.

Mass., Roxbury (Boston P. O.)—The J. J. Walsh Co., 1540 Columbus Ave., awarded the contract for the construction of a 2 story, 50 x 100 ft. factory for the manufacture of automobile bodies. Estimated cost $30,000. Noted Oct. 19.

Mich., Kalamazoo—The Kalamazoo Blow Pipe Co., 408 Church St., is having plans prepared for the construction of a 1 story, 35 x 155 ft. factory. Estimated cost $50,000. E. Batterson, Archt.

Mich., Muskegon Heights—The Maxim Motor Co. awarded the contract for the construction of a 1 story, 62 x 240 ft. factory. Estimated cost $30,000.

N. Y., Brooklyn—B. A. Davies, c/o B. Driesler, Jr., Engr. and Archt., 153 Remsen St., will build a 1 story, 100 x 200 ft. garage on Empire Blvd. Estimated cost $115,000.

N. Y., New York—The Dept. of Water Supply, Gas and Electricity, Municipal Bldg., awarded the contract for the construction of a garage on East 24th St. Estimated cost $23,700. Noted Oct. 5.

N. Y., New York—M. Low, c/o L. Sheinart, Engr. and Archt., 194 Bowery, will soon receive bids for the construction of a 3 story, 100 x 125 ft. garage on Amsterdam Ave. and 57th St.

O., Cleveland—The Brough Co., 3823 St. Clair Ave., manufacturer of beverages, is having plans prepared for the construction of a 1 story, 30 x 80 ft. and 50 x 80 ft. garage and bottling works on East 72nd St. and St. Clair Ave. Estimated cost $40,000. E. Brough, Mgr. J. Brugnone, 3505 Woodlawn Ave., Archt.

O., Cleveland—The Glauber Brass Mfg. Co., 7706 Platt Ave., plans to alter and build a 1 and 2 story addition to its factory. Estimated cost $50,000. M. Glauber, Pres. Private plans.

O., Cleveland—The Hydraulic Press Steel Co., Hydraulic Ave., awarded the contract for the construction of two 1 story, 30 x 30 ft., 33 x 40 ft. factories, and a 20 x 50 ft. crane runway. Estimated cost $50,000.

O., Cleveland — The Mall Motor Co., 4900 Euclid Ave., awarded the contract for the construction of a 1 story, 50 x 150 ft. garage. Estimated cost $40,000. A. Hass, Mgr.

O., Cleveland—J. Sands, East 55th St. and Sweeney Ave., manufacturer of water heaters, awarded the contract for the construction of a 1 story, 60 x 100 ft. machine shop at 10205 Harvard Ave. Estimated cost $40,000.

O., Kent—The Falls Rivet Co. awarded the contract for the construction of a 1 story, 168 x 210 ft. addition to its factory. Estimated cost $50,000.

Pa., Pittsburgh—The Guibert Steel Co., Diamond Bk. Bldg., is having plans prepared for the construction of a 1 story, 55 x 200 ft. steel fabricating plant on West Park St. Estimated cost $100,000. Private plans.

Pa., Sharon—R. Deflin plans to build a 1 to 2 story, 30 x 50 ft. welding and machine shop on River Ave. Estimated cost $6,000.

Tex., Waco—The Texas Fireproof Storage Co. awarded the contract for the construction of a 4 story, 50 x 100 ft. warehouse and garage on 11th and Mary Sts. Estimated cost $100,000.

Wis., Milwaukee—The O. Jaeger Baking Co., 914 Central Ave., awarded the contract for the construction of a 1 story, 50 x 150 ft. garage on 9th St. Estimated cost $40,000. Noted Oct. 26.

Wis., Wausau—The Wausau Wrecking Co. awarded the contract for the construction of a 4 story, 60 x 120 ft. garage. Estimated cost $40,000.

General Manufacturing

Mich., Muskegon—The Central Paper Co. is receiving bids for the construction of a 3 story factory, consisting of six buildings, on Lake St. Estimated cost $200,000. Private plans.

N. Y., Rochester—W. B. Williams, 295 Monroe Ave., plans to build an addition to paint shop. Estimated cost $6,500. Architect not announced.

Pa., Pittsburgh—The McCallum Co., 137 7th St., florists, receiving bids for the construction of a 3 story, 40 x 120 ft. factory at 1803 Beam Ave. Estimated cost $20,000. Private plans.

Tenn., Chattanooga—The Dixie Spinning Mills is building a 1 and 2 story, 67 x 387 ft. mill, and a 40 x 156 ft. boiler, machine shop and pump building. Estimated cost $500,000. Noted July 13.

Tex., Dallas—The Stickle Lumber Corp., Maple Ave. Rd., will build a 1 story, 100 x 200 ft. and 60 x 60 ft. flooring mill and power plant. Estimated cost $75,000.

Vt., Brattleboro—The Twin State Gas & Electric Co., Barber Bldg., is receiving bids for the construction of an addition to gas plant, including scrubbers, holders, etc. Estimated cost $40,000. Private plans.

Va., Gore—The Winchester Lumber Co., Winchester, plans to build a lumber mill, here. Estimated cost $35,000. W. B. Cornwell, Pres. Architect not announced.

Wis., Antigo—The Pacific Ice Cream Co. awarded the contract for the construction of a 2 story, 50 x 64 ft. ice cream factory. Estimated cost $50,000. H. Quackenbush, Mgr. Noted Sept. 21.

Wis., Fort Atkinson — The Better Sox Knitting Co., 211 South Water St., is receiving bids for the construction of a 2 story, 50 x 66 ft. factory. Estimated cost $40,000. D. Becker, Mgr. Private plans.

Wis., Kaukauna—The Ground Wood Pulp Supply Co. will build a 2 story, 60 x 80 ft. pulp mill. Estimated cost $50,000.

Wis., Loretta (Draper P. O.)—The Hines Lumber Co., Park Falls, will build a 1 story, 75 x 100 ft. saw mill, here. Estimated cost $75,000.

Wis., Milwaukee—The Natl. Knitting Co., 905 Clinton St., awarded the contract for the construction of a 1 story, 40 x 100 ft. addition to its factory. Estimated cost $25,000.